

**EFFECTIVENESS OF VIRTUAL REALITY THERAPY UPON ATTENTION SPAN
AND CONCENTRATION AMONG SECONDARY SCHOOL STUDENTS**

BY

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**A DISSERTATION SUBMITTED TO THE TAMILNADU DR.M.G.R MEDICAL
UNIVERSITY, CHENNAI, IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER
OF SCIENCE IN NURSING**

OCTOBER 2017

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DECLARATION

I hereby declare that the present dissertation entitled “**An Experimental Study to Assess the Effectiveness of Virtual Reality Therapy upon Attention span and Concentration among Secondary School Students**” is the outcome of the original research work under taken and carried out by me, under the guidance of **Dr. Latha Venkatesan, M.Sc (N)., M.Phil (N)., Ph.D(N).,Ph.D (HDRFs)., M.B.A., Principal,** Apollo College of Nursing and **Dr. Vijayalakshmi. K, M.Sc., (N), M.A (psy), M.B.A, Ph.D.** Head of Mental Health Nursing Department, Apollo College of Nursing, Chennai.

I also declare that the material of this has not found in any way, the basis for the award of any degree or diploma in this university or any other universities.

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SYNOPSIS

Statement of the Problem

An experimental study to assess the effectiveness of virtual reality therapy upon attention span and concentration among secondary school students at selected school, Chennai.

Objectives of the study

1. To assess the level of attention span and concentration in experimental and control group of students before and after administration of virtual reality therapy.
2. To evaluate the effectiveness of virtual reality therapy by comparing the levels of attention span and concentration before and after administration of virtual reality therapy.
3. To determine the level of satisfaction among the secondary school students regarding administration of virtual reality therapy.
4. To find out the association between selected demographic variables and the level of attention span in control and experimental group before and after administration of virtual reality therapy.
5. To find out the association between selected demographic variables and the level of concentration in control and experimental group before and after administration of virtual reality therapy.

The study was carried out upon 60 Secondary school students, in Chennai. Tools such as student background characteristics proforma, mindfulness scale on level of attention span, concentration questionnaire and Rating scale on level of satisfaction of virtual reality therapy were used by the researcher to collect the data. The content validity was obtained from various experts and reliability of the tool was (cronbach's alpha) $r = 0.70$. The main study was conducted after the pilot study.

The level of attention span and concentration was assessed before and after virtual reality therapy using mindfulness scale and concentration questionnaire in the group of students. Virtual reality therapy was administered every day morning 5 – 7 minutes for the period of one week for each student. After one week, the level of attention and concentration was assessed by using mindfulness scale and concentration questionnaire among the students. Then the level of satisfaction on virtual reality therapy was also assessed by using satisfactory scale. The data obtained were analysed using appropriate Descriptive and Inferential statistics.

Major Findings of the Study

The study findings revealed that, a more than half of students were aged between 12-13 years (53.3 %, 50%)with the mean age of 13 years, majority of school students were males (66.7%, 68.3%), studying 8th class (60%, 56.7%), and their academic performance (marks scored in previous academic year)was between 76-90 percentage (50%, 46.7%). Most of the school students' spending time to study in home after school has ranged between 76-90% (63.3%, 73.3%) in control and experimental group. Attention span without any distraction in majority of school students ranges between 21-30 minutes (60%, 43.3%) in control and experimental group respectively.

Findings also reveal that there is no statistically significant difference between control group and experimental group with regard to background characteristics of the students ($p>0.05$) indicating the homogeneity of the groups.

The study findings indicate that 60%, 56.7% of the control group of school students have average level to above average level of attention span before and after virtual reality therapy. Whereas among experimental group of the school students, majority were found to have average

level of attention before administration of virtual reality therapy (60%), whereas after virtual reality therapy most of them had above average level attention span (93.3%).

The study depicts that in control group majority of the students' concentration is not good (needs improvement) (83.3%, 70%) before and after virtual reality therapy. Whereas in experimental group of the school students, majority of their (70%) concentration was in need of improvement of concentration before administration of virtual reality therapy whereas after virtual reality therapy more than half of them (60%) had good concentration.

The difference in mean and standard deviation of attention span scores of school students in pre test ($M = 55.6, 57.1, SD = 7.03, 7.4$) between control and experimental group was not statistically significant ($p < 0.05$). Whereas after virtual reality therapy the difference in the mean and standard deviation ($M = 56.5, 61.9, SD = 6.9, 5.8$) between control and experimental group of school students was statistically significant ($P < 0.05$). It can be attributed to the effectiveness of virtual reality therapy upon attention span. Hence the null hypothesis H_0 "There will be no significant difference in the level of attention span in control and experimental group of school students before and after administration of virtual reality therapy" is rejected.

The difference in mean and standard deviation of concentration scores of school students in pre test ($M = 9.2, 9 \text{ \& } SD = 2.25, 3.04$) between control and experimental group was not statistically significant ($p < 0.05$). Whereas after virtual reality therapy the difference in the mean and standard deviation ($M = 8.4, 6.7, SD = 2.92, 1.90$) between control and experimental group of school students was statistically significant ($P < 0.05$). It can be attributed to the effectiveness of virtual reality therapy upon concentration. Hence the null hypothesis H_0 "There will be no significant difference in the level of concentration in control and experimental group of school students before and after administration of virtual reality therapy" is rejected.

The researcher found that most of the school students in the experimental group were highly satisfied with all aspects of virtual reality therapy.

Study findings also revealed that, there was no significant association between the level of attention span, concentration and the selected variables of the students. Hence the null hypothesis H_03 was retained.

Recommendations

- The study can be conducted on larger sample to generalize the results.
- The study can be conducted among the other group of school students like intellectually disabled children.
- The study could be replicated in other settings like the community and colleges etc.
- A study can be conducted to assess the effectiveness of virtual reality therapy on quality of life among the alcoholics, wives and children of alcoholics.
- A comparative study can be conducted to evaluate the effectiveness of various other interventions to help the school students in improving their concentration and attention span.
- The study can be conducted among the autistic children to improve attention and concentration.

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CHAPTER- I

INTRODUCTION

“Since you cannot do good to all, you are to pay special attention to those who, by the accidents of time, or place, or circumstances, are brought into closer connection with you.” - **Saint Augustine.**

Background of study

The Wealth of a nation is not so much in its of economical and natural resources but it lies more decidedly in the kind and quality of the wealth of its children and youth. It is they who will be the creators and shapers of a nation's tomorrow. The Children of today will be adults of tomorrow, leaders and activists. Their quality and personality will determine the kind of destiny that beckons the nation.

It, therefore, become mandatory for every nation and every society to nurture a strong, healthy and intellectual youth. It is the responsibility of the adults to direct the youth in desired direction. The youth of a nation is its powerhouse. Without harnessing this vast store of energy, a nation and a society cannot think of developing economically, politically, socially and intellectually. The best way to engage the youth into playing such a constructive role is to educate them with proper training in the desired direction (Sarchit, 2016).

In such competitive world, it is must for all to have good education. The importance of higher education has become increased in getting good job and position. Proper education creates lots of ways to go ahead in the future. It makes us strong mentally, socially and intellectually by increasing our knowledge level,

technical skills and good position in the job. Each and every kid has their own dream of doing something different in the life.

Better education is very necessary for all to go ahead in the life and get success. It develops confidence and helps building personality of a person. School education plays a great role in everyone's life. The whole education has been divided into three divisions such as the primary education, secondary education and Higher Secondary education. All the divisions of education have their own importance and benefits. Primary education prepares the base which helps throughout the life, secondary education prepares the path for further study and higher secondary education prepares the ultimate path of the future and whole life. Our good or bad education decides that which type of person we would in the future.

They are indeed wise, who know that the secret of success is concentration. Concentration is essential for every person whatever his vocation may be. A businessman, a barber, a blacksmith, a student or a student, all of them need concentration to succeed in their professions. By concentration we mean, the concentration of mind. The mind which Sri Krishna regarded as most restless than any other thing in Bhagvad Gita. It is very surprising to know that 90 % of the thought force is wasted by an ordinary human being in irrelevant and unnecessary things. Hence, whatever we have achieved is the results of 10 % of the thought force which we could able to utilize. What if our mind is utilized up to 100 %? If we look into past history, we would find that no great discovery has been ever made without concentrating the mind on a subject. Therefore, it becomes very important to understand the power of concentration.unless we are

master of our mind, our mastery is nothing more than a talent. Interestingly, concentration is also one of the paths to attain self-realization, the ultimate goal of human life. A good learning environment is vital; it creates an atmosphere that places children in the right mind-set to study and improves concentration levels. If a few kids in the class pay attention and respond positively, it catches on to the rest of the class (Sasson, 2001).

A child's attention span is a very important factor in the learning process. The amount of time a child spends listening and understanding the student affects how much he or she has taken from the lesson. Hyperactivity is one of the biggest enemies of good concentration; the other is the environment. If a child is not in the mood for studying, he or she will sit idly and daydream or talk and disrupt the rest of the class. A short attention span has little to do with your child and more to do with their surroundings. The average attention span of a seven-year-old is 14-25 minutes and increases by 2-5 minutes every year. It is important that students know this, so they can plan each class accordingly and teach the most important part of the lesson first (Alohausa, 2014).

Various techniques are used to improve attention span and concentration such as changes in nutritious diet, stopping multiple tasking, physical exercises and meditation (yoga, tai chi, or qi gong), using chewing gum, eating mint leaves, breathing exercises, enough sleep among these techniques virtual reality therapy is one of the important techniques which helps in improve attention span and concentration among school students (Alban, 2012).

Virtual reality was invented by Ivan Sutherland in 1956 and virtual reality was introduced in medicine by Larson in the year 1990. Virtual reality is the

technique that allows a person to participate actively in a sense of being present in the environment. Virtual reality therapy provides immediate access to the benefits of decline in anxiety. Virtual reality is a form of technology which creates computer generated world or immersive environment which people can interact. So the term “virtual reality means “near reality”.

Virtual reality therapy medicine helps to improve the co-ordination between the mind and body and improve the psychological wellbeing. Virtual reality therapy program will test an individual think quickly and act even quicker. Exercise in virtual reality therapy affects many regions with in the nervous system and sets of pleasure chemicals such as serotonin and dopamine that makes us feel calm, happy and pain free (Daniela,2012).

Some of us are visual learners, (that's why some of us prefer watching the movie vs reading the book) while others are auditory, and some people are able to learn both ways for student's that learn visually as opposed to auditory learning a simple lecture may be hard to follow, feel connected, or retain. Combining virtual reality with other traditional methods allows every style of learning to be supported like never before (Mareco, 2016).

Virtual reality treatment is a relaxation technique which refers to immersive, interactive, multisensory, viewer centered, sensoried, projector viewed theatre environments which can be explored and interacted with by a person. Thereby the person feels relief from his problems by permanently registering the positive effects in brain. Doctors and therapist often use this process to help the patients face and overcome fears, phobias and any stressful conditions. All of this

can be done in a monitored, controlled, sensed, projector viewed theatre environments, tailored to the needs of each individual patient (Webster, 2012).

Virtual reality therapy may be very useful in treating Attention span and concentration. Virtual reality technology allows the client to role-play in a virtual classroom where different situations can be practiced and then discussed. The therapist can work with the client to improve their concentration skills, as the client is able to practice concentrating on specific tasks while different distractions are introduced. The client is also able to interact with the teacher and classmates, allowing him or her to develop social skills and learn to stay on task.

As attention span and concentration often requires a multimodal treatment program, virtual reality therapy is easily combined with other therapies to provide the most comprehensive and effective intervention plan. Attentional tests imbedded in the VR world can be given to the child prior to beginning therapy. This same assessment can be repeated to provide a precise measurement of treatment progress (VRMC, 2015).

Need for study

Each school day, millions of students move in unison from classroom to classroom where they listen to 50- to 90-minute lectures. Despite there being anywhere from 20 to 300 humans in the room, there is little actual interaction. This model of education is so commonplace that we have accepted it as a given. For centuries, it has been the most economical way to “educate” a large number of students. Today, however, we know about the limitations of the class lecture, so why does it remain the most common format (Khan, 2012)

According to Kids Growth, the attention span of a child or teen who is actively trying to pay attention is 3 to 5 minutes for every year of the child's age. As a result, a 13-year-old has an attention span between 39 and 65 minutes, while a 16-year-old is capable of paying attention for 48 to 80 minutes.

A growing number of books, including the shallows, argue that the internet and digital gadgets are making it harder for us to concentrate. The Pew Research Centre in America recently surveyed almost 2,500 students and found that 77% thought that the internet had a "mostly positive" impact on students' research work, while 87% felt modern technologies were creating an "easily distracted generation with short attention spans".

Moffitt and Caspi (2006) conducted a longitudinal study on concentration with over 1,000 children in New Zealand. The study tested children born in 1972 and 1973 regularly for eight years, measuring their ability to pay attention and to ignore distractions. Then, the researchers tracked those same children down at the age of 32 to see how well they fared in life. The ability to concentrate was the strongest predictor of success.

Wilson and James (2007) conducted a study on student attention and concluded that there is little evidence to support this belief. The evidence they did find was shallow and imprecise. For example, after finding that student note-taking generally declines over the duration of a lecture, the researchers of one study expressed support for the attention span theory. But, as Wilson and Korn point out, they found no direct evidence of a consistent 10 to 15 minute attention span. In another study of student attention, trained observers watched students during a lecture and recorded perceived breaks in attention. They noted attention

lapses during the initial minutes of “settling-in,” again at 10-18 minutes into lecture, and then as frequently as every 3-4 minutes toward the end of class.

Wilson and Korn (2007) are quick to remind us that observers may not be able to accurately measure students’ attention spans, and that while there may be a pattern of decline in student attention during a lecture, the exact length of the average attention span wasn’t determined.

In today’s competitive world the attention span and concentration of the students’ are essential factor that determine one’s academic performance of the students which ultimately shapes the future of the students’. Hence it is essential for the mental health professionals and teachers to plan for the strategies to improve the attention span and concentration level of the students’.

As attention span and concentration often requires a multimodal treatment program, virtual reality therapy is easily combined with other therapies to provide the most comprehensive and effective intervention plan. Attention tests imbedded in the VR world can be given to the child prior to beginning therapy. This same assessment can be repeated to provide a precise measurement of treatment progress. Virtual reality therapy may be very useful in treating Attention span and concentration. Virtual reality technology allows the client to role-play in a virtual classroom where different situations can be practiced and then discussed. The therapist can work with the client to improve their concentration skills, as the client is able to practice concentrating on specific tasks while different distractions are introduced. The client is also able to interact with the teacher and classmates, allowing him or her to develop social skills and learn to stay on task (VRMC, 2015).

Kinetic adventure game package is one of the most effective virtual reality therapy games which include various games like 20,000 leaks, river rush, reflex ridge, space pop. Among them 20,000 leaks games are the most effective sleep pattern for schizophrenic clients. In 20,000 Leaks, the player's avatar is in a glass cube underwater. The player positions his or her limbs and head to plug cracks as crabs, fish, and bosses such as sharks and swordfish cause cracks and holes in the cube. As difficulty increases, up to five leaks must be plugged at a time to earn Adventure pins. Each game consists of three waves, which end with expiry of indicated time or when all leaks are plugged. Extra time left over at the end of each wave is added to the Adventure pin total (Butlers, 2009).

This game allows the client to think well and motivates interest to gain more points than other clients among the group. It triggers active participation and competitive attention. This helps the school students in improving their attention span and concentration. Thus despite the presence of various therapies useful in improve attention span and concentration, virtual reality therapy is found to be useful for improving the attention span, concentration and body, mind co-ordination among patients ,however there is paucity of research in this area.

However, many children who have trouble paying attention do not have an attention deficit. They merely have a short attention span. Investigator believed that is partly due to television, movies, video games and the quick pace of modern life. Our busy lives have trained our cognitive processes to look for quick bites, fast answers. The computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical

way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors. Hence the investigator has undertaken this study to assess the effectiveness of virtual reality therapy on attention span and concentration among secondary school children.

However there is paucity of research on virtual reality therapy upon attention and concentration of the students.

Statement of the problem

An Experimental Study to Assess the Effectiveness of Virtual Reality Therapy upon Attention Span and Concentration among Secondary School Children in Selected Schools, Chennai.

Objectives of the study

- 1) To assess the level of attention span and concentration in experimental and control group of students before and after administration of virtual reality therapy.
- 2) To evaluate the effectiveness of virtual reality therapy by comparing the levels of attention span and concentration before and after administration of virtual reality therapy.
- 3) To determine the level of satisfaction among the secondary school students regarding administration of virtual reality therapy.
- 4) To find out the association between selected demographic variables and the level of attention span in control and experimental group before and after administration of virtual reality therapy.

- 5) To find out the association between selected demographic variables and the level of concentration in control and experimental group before and after administration of virtual reality therapy.

Operational Definitions

Effectiveness

It refers to improvement in the level of attention span and concentration of after administration of virtual reality therapy in experimental group as measured by mindfulness attention scale and California state university concentration questionnarrie.

Virtual Reality Therapy

It refers to immersive, interactive, multisensory, viewer centered, sensed, projector viewed theatre environments which can be explored and interacted with by a person. It will be administered to the all students everyday for 2 consecutive weeks, for 5-7 minutes each day for all the participants.

Attention span

Attention span is the degree to which a child demonstrates sustained focus on designated tasks and activities as measured by mindfulness attention scale.

Concentration

The ability to give one's attention or thought to a single object or activity as measured by California state university made quesionarrie.

Secondary School students

In this study the secondary school students refers to a studying 8 and 9th class with age of 14-16 years in recognized school in Chennai.

Null hypotheses

H₀₁: There will be no significant difference in level of attention span and concentration between experimental and control group before and after administration of virtual reality therapy.

H₀₂: There will be no significant association between selected demographical variables and level of attention span in secondary school students of before and after administration of virtual reality therapy.

H₀₃: There will be no significant association between selected demographical variables and level of concentration in secondary school students of before and after administration of virtual reality therapy.

Assumptions

The study assumes that the

- ✓ Lack of attention span and concentration impairs learning.
- ✓ Students' attention span and concentration, may be affected by various factors.
- ✓ Relaxation techniques may improve the level of concentration and attention span.
- ✓ Short span of attention and concentration measures are required for students in the schools.

Delimitations

- The study is limited to secondary school children at Chennai.
- The study period is limited to 4 weeks only.

Conceptual Framework of the Study

A framework is a group of concepts and set of propositions that spell out the relationship between them. Their overall purpose is to make scientific findings meaningful and generalised (Polit, 2012).

The conceptual framework for a particular study is the abstract, logical structure that enables the researcher to link the findings to nursing body of knowledge. A conceptual framework deals with interested concepts on abstractions that are assembled together in some rational scheme by virtue of their relevance to a common theme. It is a device that helps to stimulate research that the extension of knowledge by providing both direction and impetus. A framework may serve as a spring board for scientific advancements (Polit and Beck, 2012). The present study aims at describing the effectiveness of virtual reality therapy upon level of attention span and concentration among school students. The conceptual framework is derived from “Imogene King’s Goal Attainment model”.

Interaction

Interaction is a process of perception and communication between person and environment and between person and person represented by verbal and non-verbal behaviors that are goal directed.

Perception

Perception is “each person’s representation of reality.” The conceptual framework of the present study involves the interaction between the investigator and the 8th and 9th class school students, which includes perception, action on the part of the investigator as well as the school students.

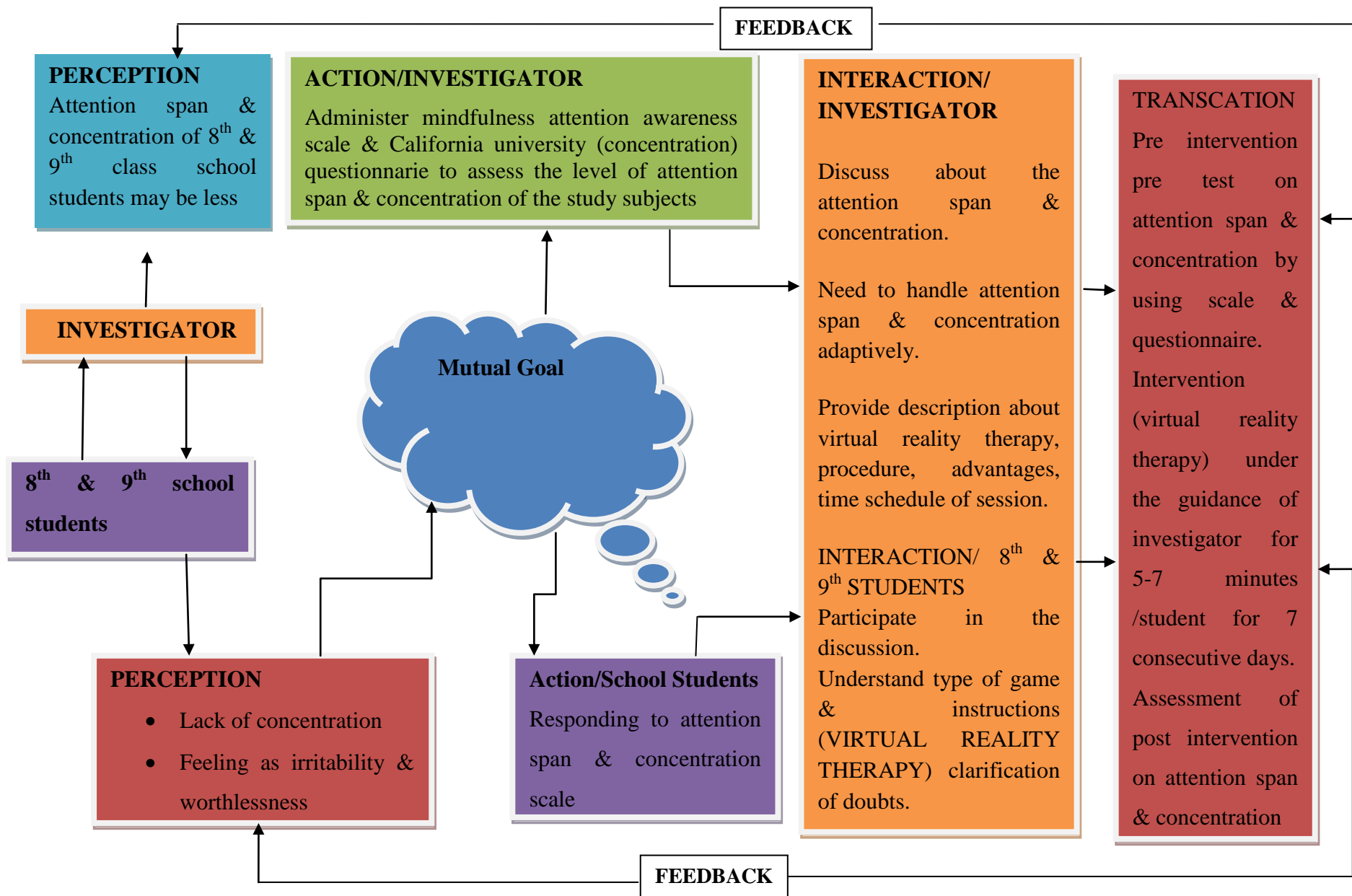


Fig:1 Conceptual Frame Work Based On Imogene King's Goal Attainment

Role

Role is defined as “a set of behaviors expected of persons occupying a position in a social system; rules that define rights and obligations in a position; a relationship with one or more individuals interacting in specific situations for a purpose.”

Action

Action is defined as a sequence of behaviors involving mental and physical action. The sequence is first mental action to recognize the presenting conditions; then physical action to begin activities related to those conditions; and finally, mental action in an effort to exert control over the situation, combined with physical action seeking to achieve goals.

Reaction

Reaction is not specifically defined but might be considered to be included in the sequence of behavior described in action.

Transaction

Transaction is a process of interactions in which human beings communicate with the environment to achieve goals that are valued; transactions are goal- directed human behaviors.

Projected Outcome

Virtual reality therapy will be useful to reduce the level of stress among school students. There will be difference in the mean attention span score virtual reality therapy will provide relaxation to the school students thereby reducing their stress.

Summary

This chapter has dealt with the background, need for the study, and statement of the problem, objectives, operational definitions, null hypotheses, assumptions, delimitations, and conceptual framework of the study.

Organization of the Report

Further aspects of the study are presented in the following five chapters.

In Chapter II : Review of literature

In Chapter III: Research methodology which includes research approach, design, setting, population, sample, and sampling techniques, tool description, content validity and reliability of tools, pilot study, data collection procedure and plan for data analysis.

In Chapter IV: Analysis and interpretation of data

In Chapter V: Discussion

In Chapter VI: Summary, conclusion, implications, recommendations and limitations.

CHAPTER II

REVIEW OF LITERATURE

A literature review is an organized written presentation of what has been published topic by scholars (Burns & Groove, 2004).

The task of reviewing literature involves the identification, selection, critical analysis and reporting of existing information on the topic of interest. This chapter deals with a review of published studies, unpublished research studies and from related material for the present study. The review helped the researcher in building the foundation of the study.

The review of literature in this chapter has been presented under the following headings:

- ✓ Attention among Students.
- ✓ Concentration among Students.
- ✓ Virtual Reality Therapy.
- ✓ Effectiveness of Virtual Reality Therapy upon Attention And Concentration.

Attention among Students

Nicholson, Kehle, et.al. (1997) conducted a study by examining the effects of physical activity on the 1) attention span and 2) health-related quality of life (HRQoL) of autism spectrum disorder (ASD) children in Singapore. Male participants ($N = 12$) aged 2-6 years, diagnosed with ASD were randomly assigned to either a physical activity (experimental) or non-physical activity group (control). In the physical activity group, participants were administered 8 tri-cycling sessions; together, both groups of participants were measured for their

attention span, and their parents completed the HRQoL questionnaires. The results revealed that as the exercise session increases, participants in the physical activity group demonstrated increasingly longer duration of attention span compared to the control group.

Lamba, Rawat, et.al. (2014) conducted a study on Attention is the most powerful asset of human beings, and if correctly used, it can have numerous benefits. At the same time it is very difficult to master. A descriptive survey was conducted to assess the impact of teaching time that is classes for two hour, on attention and concentration of student nurses. The study was conducted in selected College of Nursing, Dehradun, Uttarakhand, INDIA. Ninety one student nurses were selected by simple random sampling. Data was collected through self-reported checklist. Majority,(95% of the students), were between the age group of 18 – 22 years. Forty five percent students were from GNM group and 55% students were from B.Sc. group. Result shows that 44% students had good attention and concentration, 46% students had an average attention and concentration and 10% of students had poor attention and concentration score during the teaching - learning activities.

Concentration of Students

Raviv, Low (1990) conducted a study on Influence of physical activity on concentration among junior high-school students. The level and quality of concentration were tested before and after each lesson in one class session. Two of the four classes participated in physical education activities, and the other two studied science. Each subject matter was studied the beginning and at the end of the school day. The research design was 2 x 2 x 2 factorial (two subject matters,

two times of the school day, and as a repeated measure two times of test for each group at the beginning and end of each lesson). The level and the quality of concentration found at the end of each lesson were significantly higher than at the beginning. The subject matters did not influence concentration. It may be concluded that the time of day was the main influence on concentration, so students' claims against physical education activity lessons can be rejected. The increase in concentration toward the end of the lesson implies the need for careful lesson planning or even the consideration of increasing duration of lessons.

Twardella, Matzen, et, al (2012) conducted a cross-over cluster-randomized experimental study in 20 classrooms with mechanical ventilation systems. Test conditions 'worse' (median CO₂ level on average 2115 ppm) and 'better' (median CO₂ level on average 1045 ppm) were established by the regulation of the mechanical ventilation system on two days in one week each in every classroom. Concentration performance was quantified in students of grade three and four by the use of the d2-test and its primary parameter 'CP' and secondary parameters 'total number of characters processed' (TN) and 'total number of errors' (TE). 2366 d2-tests from 417 students could be used in analysis. In hierarchical linear regression accounting for repeated measurements, no significant effect of the experimental condition on CP or TN could be observed. However, TE was increased significantly by 1.65 (95% confidence interval 0.42-2.87) in 'worse' compared to 'better' condition. Thus, low air quality in classrooms as indicated by increased CO₂ levels does not reduce overall short-term CP in students, but appears to increase the error rate.

Sleegers, Moolenaar, et, al (2012) conducted a study on the effectiveness of lighting upon concentration among school students. Study was designed as a pre-test-post-test nonequivalent control group study. In contrast to the first study, in study 2 two classrooms within the same school in the west of the Netherlands were appointed to the control and experimental condition. The lighting of the experimental classroom (post-tests) was six luminaires with constant Focus setting of the dynamic lighting in the period 21 January 2011 to 18 February 2011. The control group was equipped with conventional lighting. The concentration tests were administered on the same days in both the experimental and the control classroom. A total of 44 pupils participated in the study (23 boys; 21 girls; average age=10 years); 22 pupils from the control classroom and 22 pupils from the experimental classroom. Pupils with learning disabilities (e.g. dyslexia, behavioral disorder) were excluded from the sample. The findings suggest that above an overall learning effect for pupils in both classrooms, the Focus light setting had a positive effect on pupils' concentration in the experimental classroom.

Virtual Reality Therapy

Comas, Pivik, Lafamme (1950) conducted a study on Technological advances, including the use of virtual reality, have contributed enormously to improving the treatment, training, and quality of life of children with disabilities. This paper describes the advantages of VR for children with disabilities, how VR can minimize the effects of a disability, the role of VR in training and skills enhancement, and how social participation and the child's quality of life may be improved through the use of VR.

Rahman (2011) conducted a study on the effectiveness of Virtual Reality for Motor Rehabilitation of Neurological Disorder. He has discussed the rationale, criteria of application, limits of the available procedures and the effects of VR in the rehabilitation of patients with stroke and those with cerebral palsy (CP). Seventeen published articles from 1/1/2002 to 1/05/2010 have been reviewed. The studies completed to date support the efficacy of application of VR in the treatment of patients after stroke and CP patients. The duration of the rehabilitation effects after discontinuing VR training is crucial.

Daniela (2012) conducted a study to find out the relationship between interactive media and stress. The study found that interactive experiences helped people manage their stress. By combining different techniques, which may produce more significant outcomes than single-strategy programs, a stress management protocol was developed to increase self awareness, to control and relax oneself, induce positive emotions, and substitute negative emotions. Stress management protocol was tested in a controlled study comparing three interactive experiences (Virtual Reality [VR], video and audio). Results showed efficacy of all three interactive experiences in inducing positive emotions and integrating different approaches to manage stress. In particular, VR showed better improvements related to the psycho-physiological changes.

Miyahira (2012) conducted a study to assess the effectiveness of virtual reality exposure therapy for PTSD (Post Traumatic Stress Disorder) in returning war fighters. The current study was a randomized controlled clinical trial designed to assess the effectiveness of a novel intervention to treat combat-related PTSD in returning Operation Iraq Freedom (OIF) and Operation Enduring

Freedom (OEF) war fighters. A cognitive behavior treatment approach augmented with Virtual Reality Exposure Therapy (VRET) was developed, and administered for treatment sessions over 5 weeks. Comparison with a control group receiving minimal attention (MA) for 5 weeks revealed that the VRE group had significant reductions¹⁹ in the avoidance/ numbing symptoms on the clinical administered PTSD scale (CAPS). The VRE group also had significant reductions in guilt at post – treatment compared to the control group.

Laver (2012) conducted a study used a randomized and quasi-randomized controlled trials that compared virtual reality with an alternative or no intervention. Nineteen studies with a total of 565 participants were included in the review. Virtual reality was found to be significantly more effective than conventional therapy in improving upper limb function (standardized mean difference of 0.53 and 95% confidence intervals (0.25 to 0.81)) based on seven studies, and activities of daily living function based on three studies. No statistically significant effects were found for grip strength (based on two studies) or gait speed (based on three studies). The findings shown that Virtual reality therapy appears to be a promising approach.

Haniff, chamberlain et al (2013) conducted a study on Virtual environments for mental health issues. Three-dimensional (3D) environments are increasingly being used to provide therapy to those suffering from mental health problems. Virtual environments can provide a safe and realistic simulation to expose patients to the cause of their problem. This paper presents a review of the use of 3D environments to assess and treat mental health problems. Within the review applications to treat mental health problems such as post-traumatic

disorder, autism and phobias are described. The areas reviewed in this paper describe more recent works in the area of three-dimensional interfaces for the treatment of mental health problems.

Malbos (2013) conducted a study on virtual reality in treatment of mental disorders. The study depicts the utility of virtual reality therapy for assessment and therapy through the various clinical studies carried out on subjects exhibiting diverse mental disorders. Even though clinical experiments set on a larger scale, extended follow-up and studies about factors influencing presence are needed, virtual reality exposure represents an efficacious, confidential, affordable, flexible, interactive therapeutic method which application will progressively widened in the field of mental health. Virtual reality and interactive video gaming are innovative therapy approaches in the field of stroke rehabilitation. The impact on secondary outcomes including activities of daily living was also assessed.

Cho (2013) conducted a study on the effectiveness of the virtual walking training program using a real-world video recording on walking balance and spatiotemporal gait parameters in patients with chronic stroke. Fourteen patients with chronic stroke were randomly assigned to either the experimental group ($n = 7$) or the control group ($n = 7$). The subjects in both groups underwent a standard rehabilitation program; in addition, the experimental group participated in the virtual walking training program using a real-world video recording for 30 minutes a day for 6 wks. Walking balance was measured using the Berg Balance Scale (BBS) and the Timed Up and Go test. Gait performance was measured using an electrical walkway system. In walking balance, greater improvement on

the Berg 18 Balance Scale and the Timed Up and Go test was observed in the experimental group compared with the control group at $P < 0.05$. This study demonstrated the positive effects of virtual walking training program using a real-world video recording on gait performance.

Shiri, Wexler, et, al (2014) conducted a study on the effectiveness of virtual reality for elevating hope among children with attention deficit and hyper activity disorder. In this study researcher carried with 13 subjects who are diagnosed as ADHD children. The virtual classroom used for evaluation and treatment of ADHD is a familiar and well studied model used to examine various neuropsychological abilities in an environment that simulates a real class- room. elevating hope among children with ADHD utilizing a self- face recognition paradigmspecifically designed for the needs of children with ADHD has the potential for providing an emotion- ally positive experience that is therapeutically beneficial in treating the cognitive impairments.

Goetz, Davis, et al (2014) conducted a study on effectiveness of virtual reality- based instruction on students' learning outcomes in K-12 and higher education. Study design was meta- analysis to examine overall effect as well as the impact of selected instructional design principles in the context of virtual reality technology-based instruction (games, stimulation, virtual world) in k-12 or higher education settings, used experimental or quasi experimental research designs. A total of 13 studies games, 29 studies stimulation, 27 studies were based on virtual world are selected for study. The study findings revealed that, virtual reality environment is effective for teaching in k-12 and higher education.

Summary

This chapter has dealt with review of literature related to the problem stated. It has helped the researcher to understand the impact of problem under study. It has also enabled the investigator to design the study, develop the tools, and plan the data collection procedure and to analyze the data. The literatures presented here were extracted from 10 primary sources and 2 secondary sources.

CHAPTER III

RESEARCH METHODOLOGY

The methodology of research study is defined as the way the information is gathered in order to answer the research question or to analyze the research problem (Polit and Beck, 2014).

This study was conducted to assess the effectiveness of virtual reality therapy upon attention span and concentration among school students in selected school, Chennai. This chapter deals in brief on different steps undertaken by the investigator for the study. It involves research approach, the setting, population, sample, sampling technique, selection of tool, content validity, reliability, pilot study, data collection procedure and plan for data analysis.

Research Approach

Research approach indicates basic procedures for conducting research. Research approach is a systematic, controlled, empirical, and critical investigation of natural phenomena guided by theory and hypothesis about the relation among such phenomena. (Polit and Beck, 2014).

This is a quantitative research study involving the measurement of attention span and concentration. So keeping in mind the nature and objectives of the study an experimental approach was considered for the study.

In an experimental study, causality between the independent and dependent variables is examined under highly controlled conditions and experimental research is considered the most powerful quantitative method

because of the rigorous control of variables. In this study experimental research approach was used.

Research Design

Research design is the overall plan for obtaining answers to the questions being studied and for handling some of the difficulties encountered during the research process. The research design is the architectural backbone of the study (Polit and Beck, 2014).

To accomplish the objectives the research design, true-experimental, pre test and post test design was used in the study. True-experimental designs facilitate the search for knowledge and examination of causality in which manipulation, control, randomization are all possible.

A true experimental pre and post test design was used by the researcher for this study.

R	O1	–	O2
R	O1	X	O2

X - Virtual reality video game for 5-7 mins, for 6 consecutive days using X-box and television.

O1 - Pretest assessment of level of attention span and concentration in control group and experimental group of school students. Assessment was done using mindfulness scale and California university concentration scale.

O2 – Posttest assessment of level of attention span and concentration in control and experimental group of school students.

R - Randomization was done by allocating all the even number students to experimental group and odd number students to control group.

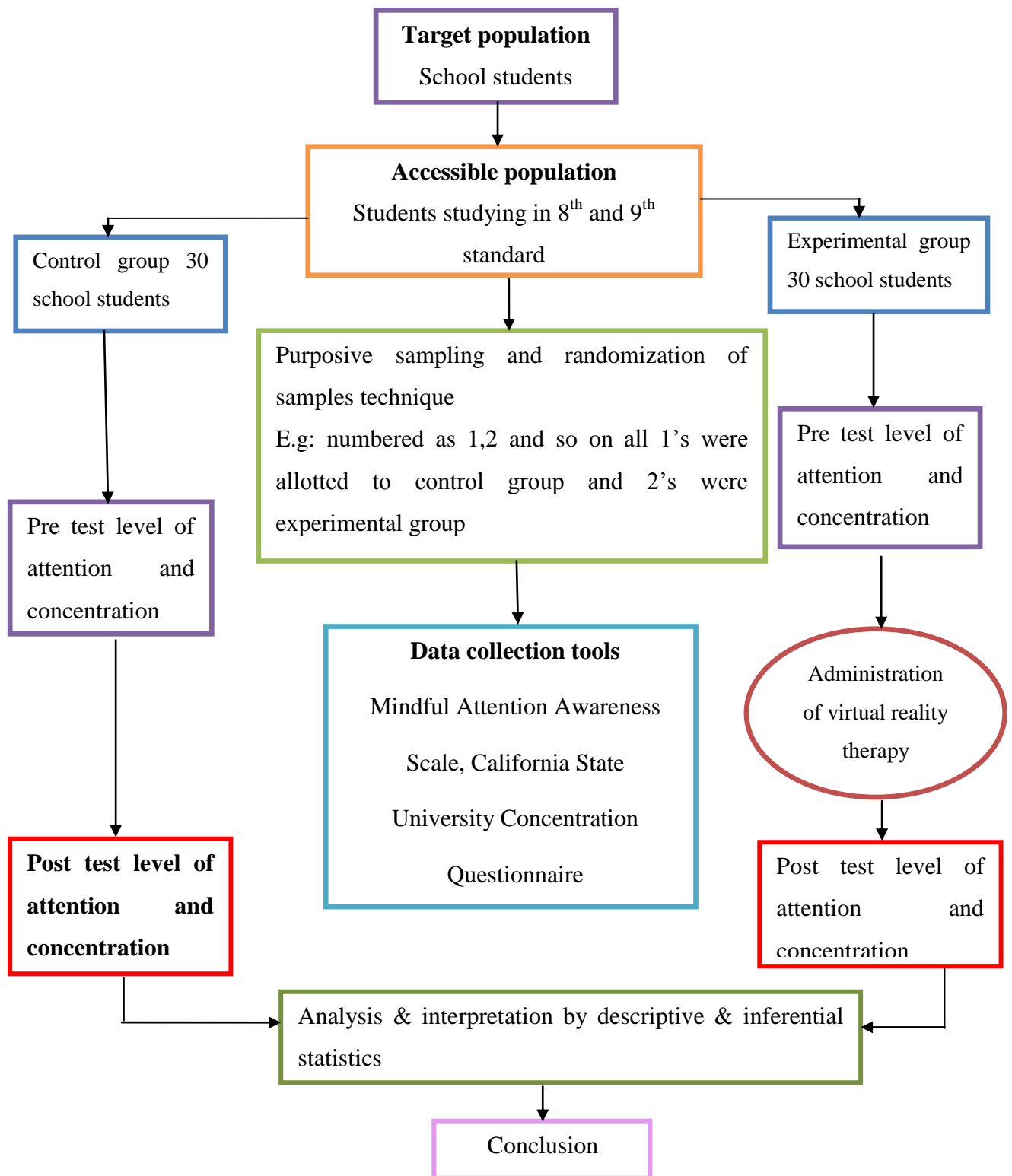


Fig 2: Schematic Representation of Research Design

Variables

Variable is an attribute that varies, that takes on different values (Polit and Beck, 2014).

Dependent Variables

The variable hypothesized to be caused by another variable. In this study dependent variables are attention span and concentration.

Independent Variable

The variable hypothesized to the outcome variable of interest. In this study independent variable is virtual reality therapy.

Attribute Variables

A variable that confounds the relationship between the independent and dependent variables that needs to be controlled either in the research design or through statistical procedures (Polit and Beck, 2014).

In this study the attribute variables are demographic variables such as age, number of classes, academic performance, number of hours spent to study after school were the attribute variables in this study.

Research Setting

Research settings are the most specific places where data collection occur (Polit and Beck 2014).

The present study was conducted in UCCK School, Chennai.

UCCK School is situated at Ayanambakkam one kilometer away from Apollo College of Nursing. The total student strength of the school is 615

students. The school has all the facilities required for the students to learn. The school has 28 teaching faculties and 4 non teaching faculties. The medium of instruction is English.

The setting was chosen based on the feasibility in terms of availability and accessibility of adequate samples and cooperation of concerned authorities.

Population

Polit and Beck (2014) stated that the population is the entire aggregation of cases which meet designed set criteria. In this study, the target population comprises of school students.

Target population

The target population is the group of population that the researcher aims to study and to whom the study findings will be generalized. In this study target population comprises of all the school students who satisfy the inclusion criteria.

Accessible population

The accessible population is the list of population that the researcher finds in the study area. The accessible population in this study are the school students who satisfy the inclusion criteria in selected school, Chennai.

Sample

Polit and Beck (2014) stated that sample consists of the subset of units that comprises the population. In this study samples consisted of 8th and 9th standard students who met the inclusion criteria in selected schools, Chennai.

Sample Size

A sample size of 60 school students who met the inclusion criteria were chosen for this study, in that 30 odd numbers were taken for control group and 30 even numbers were for experimental group.

Sampling Technique

It was stated by Polit and Beck (2014) that sampling technique refers to the process of selecting a portion of the population to represent the entire population.

Sixty four students were selected from 8th and 9th standard by purposive sampling technique. They were numbered as 1, 2, 1, 2 and so on. All ones' were allotted to control group and all 2's were allotted to experimental group randomly.

Sampling Criteria

Inclusion Criteria

The study included

- Students studying 8th and 9th standard in UCCK school.
- Available at the time of data collection.

Exclusion Criteria

The study excluded

- Students who were not willing to participate in the study.
- Slow learners and students with any learning disability.

Selection & Development of Study Instruments

The study aimed at evaluating the effectiveness of virtual reality therapy upon attention and concentration in school students. The data collection instruments were developed through an extensive review of literature in

consultation with experts and with the opinion of faculty members. The instruments used in this study were proforma to collect background characteristics of students', Mindfulness Attention Awareness Scale, California university concentration scale and rating Scale on level of satisfaction regarding virtual reality therapy.

Background Characteristics of School Students

Student background characteristics consisted of age, gender, grade, number of hours spent for study after school and academic performance.

Mindful Attention Awareness Scale

It is an standardized tool which consists of 15 items with 6 options such as (Almost Always, Very Frequently, Somewhat Frequently, Somewhat Infrequently, Very Infrequently, Almost Never) and score ranged from 1 to 6. Scoring varied based on responses of participants. Hence total obtainable scores was 15-90.

Obtained score was interpreted on following:

- Low 15- 35
- Average 36- 55
- Above average 56- 75
- High 76- 90

California State University Concentration Questionnaire

In this study California state university concentration questionnaire was used to assess the concentration. Original version of this tool consisted of 20 items. This tool was slightly modified by the researcher by removing 3 items, as

per the suggestions given by panel members of ethics committee and experts opinion. Hence the final tool consisted 17 items with 2 options such as Yes and No. Score one was given for all yes responses and zero for all no responses. Hence total obtainable scores was 0-17.

Obtained score was interpreted on following:

- Good concentration 0- 5
- Needs improvement 6- 11
- Needs more help & improvement 12-17

Rating scale to assess the level of satisfaction on Virtual Reality Therapy

This scale was developed by the investigator. It consists of 12 items regarding virtual reality therapy. Responses extend from highly satisfied, satisfied, dissatisfied, and highly dissatisfied. Then the total score was obtained and the obtained score was converted into percentage and interpreted as follows,

Score Percentage Level of satisfaction

Score	Percentage	Level Of Satisfaction
≥ 36	76 – 100	Highly Satisfied
23 – 35	50 – 75	Satisfied
11 – 22	25 – 49	Dissatisfied
1 - 10	1 – 24	Highly Dissatisfied

Psychometric Properties of the Study Instruments

Validity

Content validity is the degree to which an instrument measures what it is supposed to measure. Content validity is the sampling adequacy of the content being measured (Polit and Beck, 2014).

The Mindful Attention Awareness Scale and California concentration scale is the most widely used psychological instrument for measuring the level of attention span and concentration. Attention span tool is a standardized tool developed by Carlson and Brown and concentration standardized tool developed in California state university. The content validity of the tools was obtained by getting opinion from experts. The experts have suggested some specific modifications in the tools. The modifications and suggestions of experts were incorporated in the final preparation of the tool.

Reliability

Reliability is the degree of consistency with which an instrument measures the attribute which is designed to measure (Polit and Beck, 2014).

Reliability of Mindful Attention Awareness Scale was 0.70 (Cronbach's alpha). Reliability of California state university concentration scale was 0.80 (Cronbach's alpha). Hence the tools were considered reliable for proceeding with the main study.

Pilot Study

Polit and Beck (2014) stated that a pilot study is a miniature version of actual study in which the instruments are administered to the subjects drawn from the same population. The purpose is to find out the feasibility and practicability of the tool.

The pilot study was conducted among 8th and 9th standard students of UCKK school, Chennai. The subjects were chosen by simple random sampling technique, 5 in control group and 5 in experimental group. Level of attention and concentration was assessed for both control group and experimental group. Virtual reality therapy was administered for experimental group for 6 days. There was no intervention for control group. Level of Attention and concentration was assessed by using Mindful Attention Awareness Scale and concentration scale for experimental group for 6 days after intervention. Then the level of satisfaction regarding virtual reality therapy was assessed using rating scale for experimental group. On the whole virtual reality therapy was found to be feasible and acceptable.

Protection of Human Rights

The study was conducted after the approval of ethics committee, Apollo Hospitals, Chennai. Permission was obtained from Principal, Apollo college of Nursing, HOD of Psychiatry & Mental health Nursing Department. The participants were explained about the study and obtained written consent after providing assurance and developing confidence. Confidentiality of the data was maintained throughout the study.

Intervention Protocol

The researcher was trained for one week in proceeding virtual reality therapy and was certified before data collection.

The virtual reality therapy is an artificial environment created by software and projected by capturing the user by sensor. The user will be projected in the screen as a disease free user. The person suspends the belief of presence of disease and accepts the real environment. When the brain is preoccupied with virtual environment, it does not perceive other stimuli as effective as it otherwise good. This mechanism in turn, greatly lessens the sensation of real disease of the patient.

The investigator used the “Kinect Adventures” for the administration of virtual reality therapy in which the “River Rush” was the selected module as it involves several body movements and enhances the proper functioning of higher mental functions such as attention and concentration. This in turn helps to improve the confidence and self esteem and thereby reduces the level of anxiety of the participants.

In “River Rush”, one or two players stand in a raft and work together to pick up the adventure pins scattered throughout the winding rapids. The raft is controlled by stepping left or right to steer, and by jumping to jump the raft. There are many secret places that you can get to by taking ramps. There are considerably more adventure points there than on the river. Crashing into barrels, wood, markers, or rapid markers, causes the player to lose points.

It refers to immersive, interactive, multisensory, viewer centered, sensed, projector viewed theatre environments which can be explored and interacted with by a person. It will be administered to the all students everyday for 2 consecutive weeks, for 5-7 minutes each day for all the participants.

Data Collection Procedure

Data collection is gathering information about something which the researcher has chosen to explore or investigate (Polit and Beck, 2014).

The researcher was trained for one week in proceeding virtual reality therapy and was certified before data collection. Permission was obtained from the Principal of the UCKK, school, Chennai. The data collection period was from the month of November to December, 2016. After initial introduction, the researcher obtained consent from the students who participated in the study. An assurance was given regarding confidentiality before data collection procedure. Purposive sampling technique was used to select the samples. Randomization was done by assigning even number students to experimental group and odd number students to control group. Mindful Attention Awareness Scale and concentration scale were administered to the students and their level of attention

and concentration was assessed in both control and experimental group before the virtual reality therapy intervention.

Data collection (pre test and post test) were completed first for control group of students, to avoid contamination of the data.

The investigator used the “Kinect Adventures” for experimental group students for the administration of virtual reality therapy in which the “River Rush” was the selected module as it involves several body movements and enhances the proper functioning of higher mental functions such as attention and concentration.

Study participants were gathered in a class room. Techniques of Virtual Reality Therapy was demonstrated by the researcher and return demo was taken then virtual reality was practiced by the study participants for a period of 6 days. After 6 days attention and concentration was assessed by Mindful Attention Awareness Scale and concentration scale both in control and experimental group. Then the level of satisfaction regarding virtual reality therapy was assessed using the satisfaction rating scale on virtual reality therapy in experimental group of school students. On the whole virtual reality therapy was found to be feasible and effective. The contamination of samples was avoided by collecting data from control group first and then followed by data collection from experimental group of students.

Problems faced by the researcher during the study

The researcher faced difficulty in setting up the equipment because of the obstacles of the power sources. The principal and teachers of the UCK school

were very cooperative and approachable for the researcher which provided great encouragement to the researcher.

Plan for Data Analysis

Data analysis is the systematic organization, synthesis of research data and testing of null hypothesis by using obtained data (Polit and Beck, 2014).

Analysis and interpretation of data was carried out using descriptive and inferential statistics. Descriptive statistics such as frequency, percentage, mean and standard deviation were used to describe the demographic variables & inferential statistics such as t test was used to assess the effectiveness of virtual reality therapy on the level of attention and concentration by comparing the pre test and post test mean score of attention and concentration. Chi square test was used to find out the association between selected demographic variables and level of attention span and concentration in pre test and post test among control and experimental group of students.

Summary

This chapter dealt with the selection of research approach, research design, setting, population, sample and sampling technique, selection and development of study instruments, validity and reliability of the study instruments, pilot study, data collection, procedure and plan for data analysis. The following chapter deals with analysis and interpretation of data using descriptive and inferential statistics.

CHAPTER-IV

ANALYSIS AND INTERPRETATION

The analysis is defined as the method of organizing data in such a way that the research question can be answered. Interpretation is the process of the results and of examining the simplification of findings with a broader context (Polit and Beck, 2014).

This chapter deals with analysis and interpretation including both descriptive and inferential statistics. Statistics is a field of study concerned with techniques or methods of collection of data, classification, summarizing, interpretation, drawing inference, testing of hypothesis, making recommendations (Mahajan, 2010).

The data was analyzed according to the objectives and hypothesis of the study. Analysis of the study was compiled after all the data was transferred to the master coding sheet. The investigator used descriptive and inferential statistics for analysis. The data was analyzed, tabulated and interpreted using appropriate descriptive and inferential statistics.

Organization of the findings

The findings of the study were organized and presented under the following headings

1. Frequency and percentage distribution of background characteristics of the control and experimental groups of students (Table 1).

2. Frequency and percentage distribution of level of attention span before and after virtual reality therapy in control and experimental group of school students (Table 2).
3. Frequency and percentage distribution of level of concentration before and after virtual reality therapy in control and experimental group of school students (Table 3).
4. Comparison of mean and standard deviation of attention span before and after virtual reality therapy between control and experimental group of school students (Table 4).
5. Comparison of mean and standard deviation of concentration before and after virtual reality therapy between control and experimental group of school students (Table 5).
6. Frequency and percentage distribution of level of satisfaction on administration of virtual reality therapy in school students (Table 6).
7. Association Between the Selected Variables and the Level of Attention Span in School Students Before and After Virtual Reality Therapy in Control group (Table 7).
8. Association between the selected variables and the Level of attention span in school students before and after virtual reality therapy (Table 8).
9. Association between the selected variables and the level of concentration in school children before and after virtual reality therapy in control group (Table 9).
10. Association between the selected variables and the level of concentration in school children before and after virtual reality therapy in experimental group (Table 10).

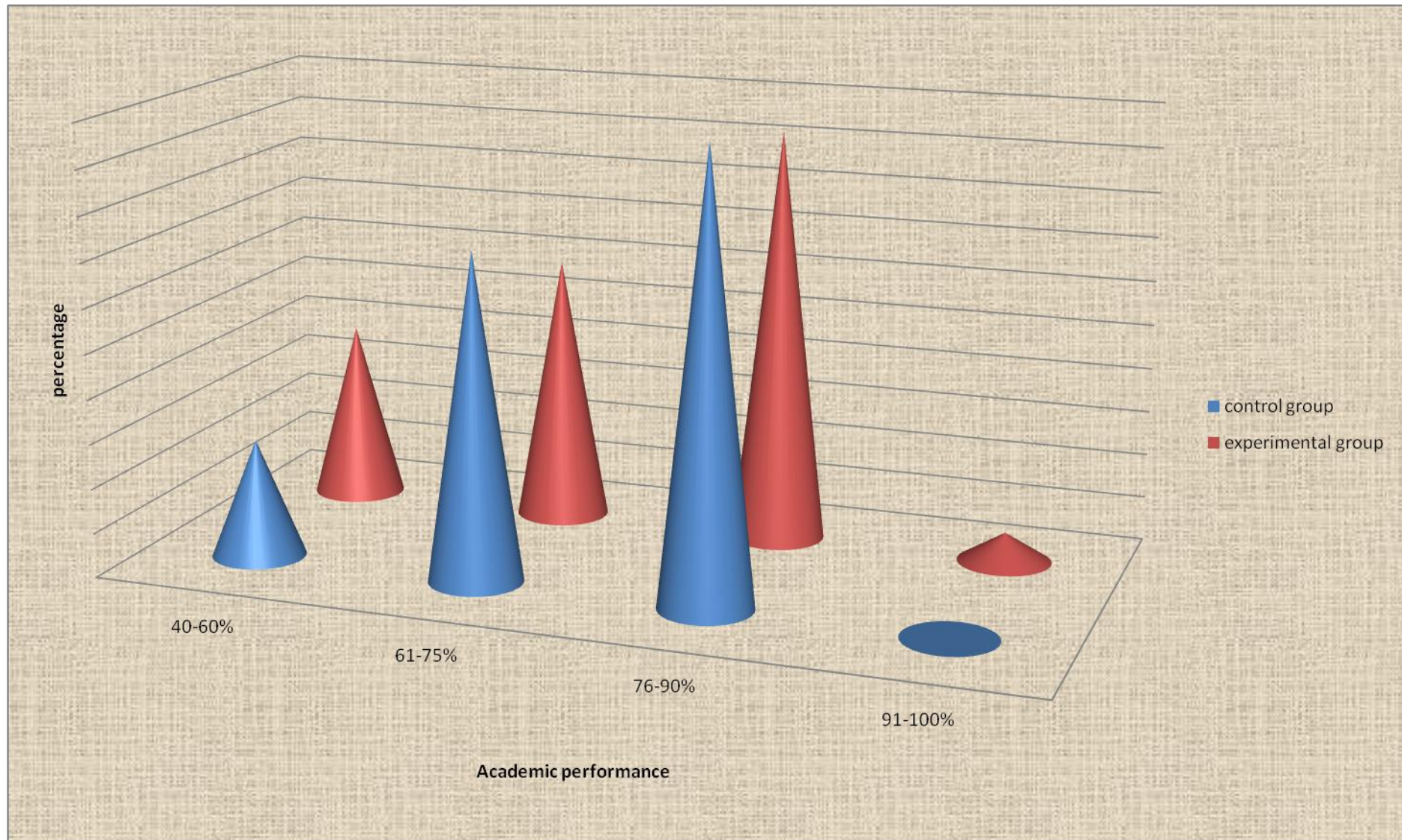


Fig 3: Percentage Distribution of Academic Performance in Control and Experimental Group of School Students

Table:1 Frequency and Percentage Distribution of Background Characteristics of the Control and Experimental groups of Students

(N=60)

Background characteristics	Control group (n=30)		Experimental group (n=30)		χ^2	P value
	n	P	n	p		
Age						
12yrs	0	0	1	3.3	0.3	p>0.05
13yrs	16	53.3	14	46.7		
14yrs	10	33.3	9	30		
15 yrs	2	6.7	5	16.7		
16yrs	2	6.7	1	3.3		
Gender						
Male	20	66.7	19	63.3	0.05	p>0.05
Female	10	33.3	11	36.7		
Grade						
8 th	18	60	17	56.7	0.06	p>0.05
9 th	12	40	13	43.3		
Time spent in studies at home						
1-2hrs	19	63.3	22	73.3	2.66	p>0.05
3-4hrs	11	36.7	7	23.3		
5and above	0	0	1	3.3		
Attention without any distraction (as reported by students)						
10-20mins	2	6.7	8	26.7	0.06	p>0.05
21-30mins	18	60	13	43.3		
31-40mins	7	23.3	8	26.7		
41-50mins	2	6.7	1	3.3		
51-60mins	1	3.3	0	0		

Note :Relevant categories were clubbed for the computation of chi square analysis.

Table:1 shows that a more than half of students were aged between 12-13 years (53.3 %, 50%)with the mean age of 13 years, majority of school students were males (66.7%, 68.3%), studying 8th class (60%, 56.7%). Most of the school students' spending time to study in home after school has ranged between 76-90% (63.3%, 73.3%) in control and experimental group. Attention span without any distraction in majority of school students ranges between 21-30 minutes (60%, 43.3%) in control and experimental group respectively.

Findings also reveal that there is no statistically significant difference between control group and experimental group with regard to background characteristics of the students (p>0.05) indicating the homogeneity of the groups.

Table: 2 Frequency and Percentage Distribution of Level of Attention span Before and After Virtual Reality Therapy in Control and Experimental Group of School Students
(N=60)

Test	Levels	Control group (n=30)		Experimental group (n=30)	
		n	p	n	P
Pre test	Low	0	-	0	-
	Average	8	60	18	60
	Above average	12	40	11	36.7
	High	0	-	1	3.3
Post test	Low	0	-	0	-
	Average	13	43.3	1	3.3
	Above average	17	56.7	28	93.3
	High	0	-	1	3.3

The data presented in table 2 depicts that 60%, 56.7% of the control group of school students have average level to above average level of attention span before and after virtual reality therapy respectively. Whereas among experimental group of the school students, majority were found to have average level of attention before administration of virtual reality therapy (60%), whereas after virtual reality therapy most of them had above average level attention span (93.3%).

Table: 3 Frequency and Percentage Distribution of level of Concentration Before and After Virtual Reality Therapy in Control and Experimental Group of School Students.

(N=60)

Test	Levels	Control group (n=30)		Experimental group (n=30)	
		n	P	n	p
Pre test	Good concentration	4	13.3	6	20
	Needs improvement	25	8.3	21	70
	Needs more help and improvement	1	3.3	3	10
Post test	Good concentration	7	23.3	18	60
	Needs improvement	21	70	12	40
	Needs more help and improvement	2	6.7	0	-

The data presented in table 3 depicts that majority of the control group of school students' concentration is not good (needs improvement) (83.3%, 70%) before and after virtual reality therapy respectively. Whereas among experimental group of the school students, majority of their (70%) concentration was not good, (needs improvement of concentration) before administration of virtual reality therapy, whereas after virtual reality therapy more than half of them (60%) had good concentration.

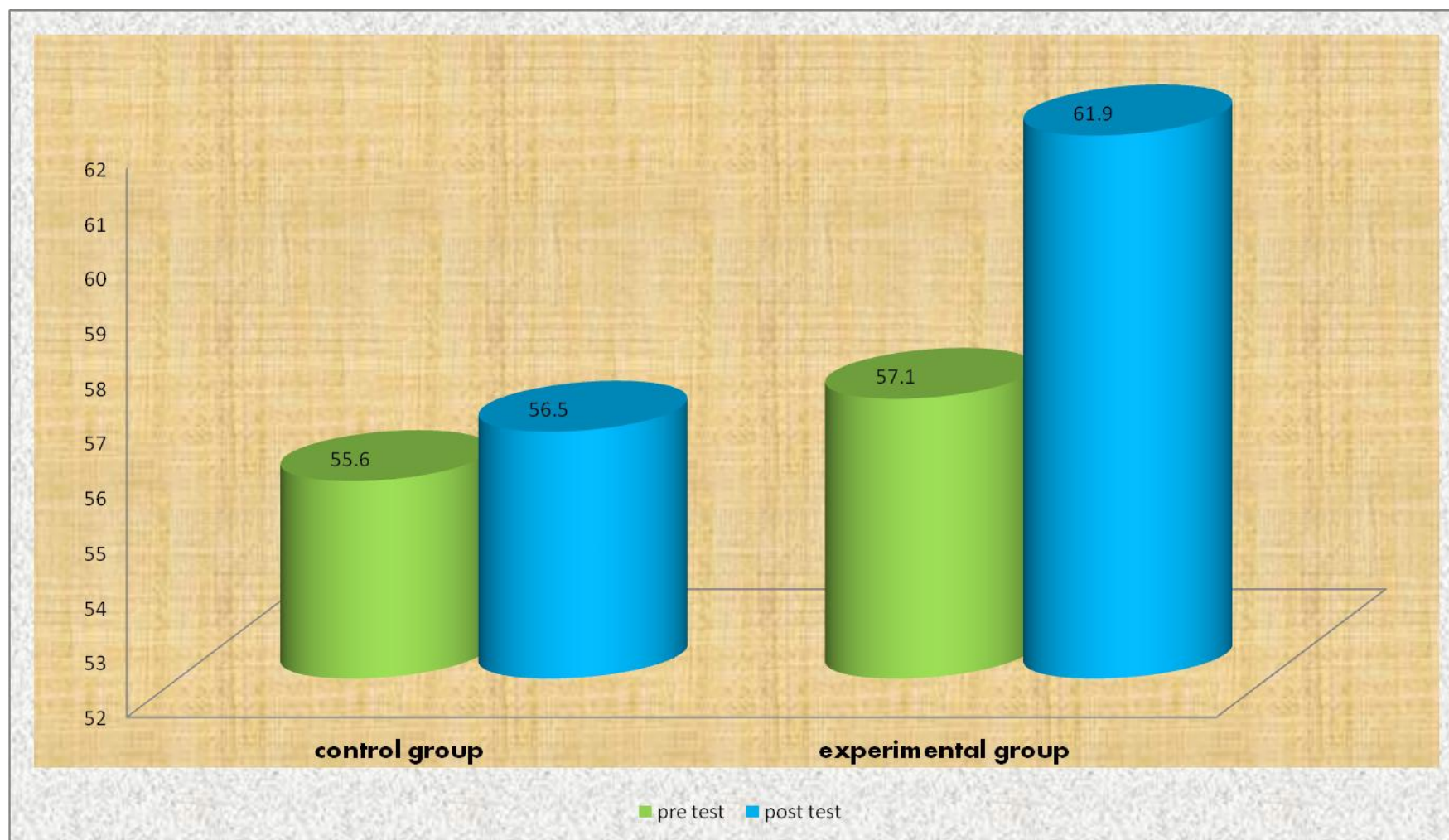


Fig 4: Comparison of Mean scores of Attention Span Before and After Virtual Reality Therapy between Control and Experimental Group of School Students

Table:4

Comparison of Mean and Standard Deviation of Attention Span Before and After Virtual Reality Therapy Between Control and Experimental group of School Students

(N=60)

	Pre test		Independent t test value	Post test		Independent t test value
	Mean	S D		Mean	S D	
Control group (n=30)	55.6	7.03	0.80 (NS)	56.5	6.9	3.29***
Experimental group (n=30)	57.1	7.4		61.9	5.8	

*****P<0.001**

NS – not significant

The data presented in the table 4 depicts the difference in mean and standard deviation of attention span scores of school students in pre test (M= 55.6, 57.1, SD= 7.03, 7.4) between control and experimental group which was not statistically significant ($p < 0.05$). Whereas after virtual reality therapy the difference in the mean and standard deviation (M= 56.5, 61.9, SD= 6.9, 5.8) between control and experimental group of school students was statistically significant ($P < 0.05$). It can be attributed to the effectiveness of virtual reality therapy upon attention span. Hence the null hypothesis Ho1 “There will be no significant difference in the level of attention span in control and experimental group of school students before and after administration of virtual reality therapy” is rejected.

Table : 5

Comparison of Mean and Standard Deviation of Concentration Before and After Virtual Reality Therapy Between Control and Experimental group of School Students (N=60)

	Pre test		Independent t test value	Post test		Independent t test value
	Mean	S D		Mean	S D	
Control group (n=30)	9.2	2.25	0.29 (NS)	8.4	2.92	2.57*
Experimental group (n=30)	9	3.04		6.7	1.90	

***P<0.05**

NS – Not significant

The data presented in the table 5 depicts the difference in mean and standard deviation of concentration scores of school students in pre test (M= 9.2, 9 & SD= 2.25, 3.04) between control and experimental group was not statistically significant ($p < 0.05$). Whereas after virtual reality therapy the difference in the mean and standard deviation (M= 8.4, 6.7, SD= 2.92, 1.90) between control and experimental group of school students was statistically significant ($P < 0.05$). It can be attributed to the effectiveness of virtual reality therapy upon concentration. Hence the null hypothesis H_0 1 “There will be no significant difference in the level of concentration in control and experimental group of school students before and after administration of virtual reality therapy” is rejected.

Table : 6

Frequency and Percentage Distribution of Level of Satisfaction on Administration of Virtual Reality Therapy in Experimental Group of School Students

(n=30)

Domain	Highly Satisfied		Satisfied		Dissatisfied		Highly Dissatisfied	
	n	p	n	p	n	p	n	P
About the method of Exercise (virtual reality therapy)	25	83.3	5	16.7	-	-	-	-
About the effect of Exercise	26	86.7	4	13.3	-	-	-	-
About the Researcher	23	76.7	7	23.3	-	-	-	-

It is inferred from the table 6 that most of the school students in the experimental group were highly satisfied with all aspects of virtual reality therapy.

Table: 7

Association Between the Selected Variables and the Level of Attention Span in School Students Before and After Virtual Reality Therapy in Control group

(n=30)

Selected Variables	Before therapy		χ^2	After therapy		χ^2
	Up to mean	Above mean		Up to mean	Above mean	
Age						
Up to 14 years	13	13	0.53#	14	12	0.44#
Above 14 years	3	9	(df=1)	3	1	(df=1)
Gender						
Male	12	8	1.09	13	7	0.61
Female	4	6	(df=1)	5	5	(df=1)
Grade						
8 th	11	8	0.41	12	6	0.83
9 th	5	6	(df=1)	6	6	(df=1)
Academic Performance						
Up to 75	9	6	0.52	9	7	0.72
Above 75	7	8	(df=1)	8	6	(df=1)
Time to study in home						
Up to 2 hrs	11	7	1.2#	13	6	6.33#
Above 2 hrs	4	7	(df=1)	3	8	(df=1)
Attention without any distraction						
Up to 30 Min	11	8	0.41	10	9	0.12
Above 30 Min	5	6	(df=1)	5	6	(df=1)

Note : # Yates correction value

It could be inferred from table 7 that, there was no significant association between the selected students' background characteristics and the level of attention span before and after virtual reality therapy in control group of school students. Hence the null hypothesis "there will be no significant association between selected demographic variables and the level of attention span before and after virtual reality therapy in the control group of school students" was retained.

Table: 8 Association Between the Selected Variables and the Level of Attention Span in School Students Before and After Virtual Reality Therapy in Experimental group (n=30)

Selected Variables	Before therapy		χ^2	After therapy		χ^2
	Up to mean	Above mean		Up to mean	Above mean	
Age						
Up to 14 years	15	9	0.67# (df=1)	14	10	2.6# (df=1)
Above 14 years	4	2		4	2	
Gender						
Male	11	8	0.16 # (df=1)	12	7	0.13 (df=1)
Female	8	3		6	5	
Grade						
8 th	10	7	0.07 (df=1)	11	6	0.36 (df=1)
9 th	7	6		7	6	
Academic Performance						
Up to 75%	8	7	0.55 (df=1)	5	6	2.33 (df=1)
Above 75%	10	5		14	5	
Time spend to study in home						
Up to 2 hrs	13	9	11.5# (df=1)	13	9	0.84# (df=1)
Above 2 hrs	4	4		5	3	
Attention without any distraction						
Up to 30 Min	13	8	0.22# (df=1)	14	7	0.52# (df=1)
Above 30 Min	4	5		4	5	

Note : # Yates correction value

It could be inferred from table 8 that there was no significant association between the selected students' background characteristics and the level of attention span before and after virtual reality therapy in control group of school students. Hence the null hypothesis "there will be no significant association between selected demographic variables and the level of attention span before and after virtual reality therapy in the control group of school students" was retained.

Table:9

Association Between the Selected Variables and the Level of Concentration in School Students Before and After Virtual Reality Therapy in control Group

(n=30)

Selected Variables	Before virtual reality therapy		χ^2	After virtual reality therapy		χ^2
	Up to mean	Above mean		Up to mean	Above mean	
Age			0			
Up to 14 years	13	13	(df=1)	15	11	1.41#
Above 14 years	2	2	(not applicable)	4	0	(df=1)
Gender						
Male	8	12	1.34#	13	8	0.16#
Female	7	3	(df=1)	7	2	(df=1)
Grade						
8 th	8	10	0.54	8	10	4.9#
9 th	7	5	(df=1)	11	1	(df=1)
Academic Performance						-
Up to 75	10	6	2.14	9	6	(df=1)
Above 75	5	9	(df=1)	9	6	(not applicable)
Time spend to study in home						
Up to 2 hrs	12	8	1.09	11	8	1.6#
Above 2 hrs	4	6	(df=1)	7	4	(df=1)
Attention without any distraction						
Up to 30 Min	9	11	0.14#	13	7	0.91#
Above 30 Min	6	4	(df=1)	6	4	(df=1)

Note : # Yates correction value

It could be inferred from table 9 that there was no significant association between the selected students' background characteristics and the level of concentration before and after virtual reality therapy in control group of school students. Hence the null hypothesis "there will be no significant association between selected demographic variables and the level of concentration before and after virtual reality therapy in the control group of school students" was retained.

Table:10

Association Between the Selected Variables and the Level of Concentration in School Students Before and After Virtual Reality Therapy in Experimental Group

(n=30)

Selected Variables	Before virtual reality therapy		χ^2	After virtual reality therapy		χ^2
	Up to mean	Above mean		Up to mean	Above mean	
Age						
Up to 14 years	14	10	2.6#	13	11	0.71#
Above 14 years	4	2	(df=1)	5	1	(df=1)
Gender						
Male	11	8	0.16#	12	8	2.0#
Female	8	3	(df=1)	7	3	(df=1)
Grade						
8 th	9	8	3.4#	9	8	0.25#
9 th	9	4	(df=1)	9	4	(df=1)
Academic Performance						
Up to 75%	11	4	1.24#	10	5	0.55
Above 75%	7	8	(df=1)	8	7	(df=1)
Time spend to study in home						
Up to 2 hrs	13	9	2.5#	12	10	0.16#
Above 2 hrs	6	2	(df=1)	6	2	(df=1)
Attention without any distraction						
Up to 30 Min	11	10	0.78#	12	9	2.7#
Above 30 Min	7	2	(df=1)	6	3	(df=1)

Note : # Yates correction value

It could be inferred from table 11 that there was no significant association between the selected students' background characteristics and the level of concentration before and after virtual reality therapy in control group of school students. Hence the null hypothesis "there will be no significant association between selected demographic variables and the level of concentration before and after virtual reality therapy in the experimental group of school students" was retained.

Summary

This chapter dealt with analysis and interpretation of data obtained by the researcher. The analysis of the results showed that in experimental group the level of attention span and concentration is improved after administration of virtual reality therapy, when compared to before administration of virtual reality therapy. This implied that virtual reality therapy is effective in improving the level of attention span and concentration among the school students.

CHAPTER V

DISCUSSION

This study was carried out to assess the effectiveness of virtual reality therapy upon attention span and concentration among school students with sample size of 60 school students, Chennai. The level of attention span and concentration was assessed before virtual reality therapy using Mindfulness scale and California state university concentration questionnaire in the group of school students. Virtual reality therapy was administered every day 5-7 minutes for the period of one week for each student. After one week, the level of concentration and attention span was assessed by using Mindfulness scale and California state university concentration questionnaire among the school students. Then the level of satisfaction on virtual reality therapy was assessed by using satisfaction scale developed by the investigator.

The discussion is presented under the following headings

- ✓ Students' background characteristics of school students
- ✓ Level of concentration and attention span among school students
- ✓ Effectiveness of virtual reality therapy on concentration and attention span
- ✓ Level of satisfaction of virtual reality therapy
- ✓ Association between the selected variables and level of attention span among secondary school students.
- ✓ Association between the selected variables and level of concentration among secondary school students.

Students' background characteristics

The study findings revealed that, a more than half of students were aged between 12-13 years (53.3 %, 50%) with the mean age of 13 years, majority of school students were males (66.7%, 68.3%), studying 8th class (60%, 56.7%), and their academic performance (marks scored in previous academic year) was between 76-90 percentage (50%, 46.7%).

Most of the school students' spending time to study in home after school has ranged between 76-90% (63.3%, 73.3%) in control and experimental group. Attention span without any distraction in majority of school students ranges between 21-30 minutes (60%, 43.3%) in control and experimental group respectively.

Findings also reveal that there is no statistically significant difference between control group and experimental group with regard to background characteristics of the students ($p>0.05$) indicating the homogeneity of the groups.

The first objective of the study was to assess the level of concentration and attention span among secondary school students before and after virtual reality therapy

The study results show that 60%, 56.7% of the control group of school students' have average level to above average level of attention span before and after virtual reality therapy.

Whereas among experimental group of the school students, majority were found to have average level of attention before administration of virtual reality therapy (60%), whereas after virtual reality therapy most of them had above average level attention span (93.3%).

The study depicts that in control group majority of the students' concentration is not good (needs improvement) (83.3%, 70%) before and after virtual reality therapy. Whereas

among experimental group of the school students, majority of them (70%) were in need of improvement of concentration before administration of virtual reality therapy whereas after virtual reality therapy more than half of them (60%) had good concentration.

Lack of concentration may be due to classroom noise level, student behavior, electronic devices, fatigue, hunger, thirst, external noises, physical affliction, personal issues. The attention span of a young child lasts roughly five minutes. Among individuals of all ages, total uninterrupted attention span rarely exceeds 40 minutes, after which time repeated refocusing is required (Dukette and Cornish, 2009).

The second objective of the study was to assess the effectiveness of virtual reality therapy by comparing the level of concentration and attention span among secondary school students before and after virtual reality therapy.

The corresponding null hypothesis was ‘There will be no significant difference in level of attention span and concentration between experimental and control group before and after administration of virtual reality therapy’.

The effectiveness of virtual reality therapy upon concentration level among the experimental group of school students was assessed statistically using the independent ‘t’ test. The difference in mean and standard deviation of attention span scores of school students in pre test (M= 55.6, 57.1, SD= 7.03, 7.4) between control and experimental group which was not statistically significant ($p < 0.05$). Whereas after virtual reality therapy the difference in the mean and standard deviation (M= 56.5, 61.9, SD= 6.9, 5.8) between control and experimental group of school students was statistically not significant ($P < 0.05$). It can be attributed to the effectiveness of virtual reality therapy upon attention span. Hence the null hypothesis H_0 1 “There will be no significant difference in the level of attention span in control and experimental group of school students before and after administration of virtual reality therapy” is rejected.

The difference in mean and standard deviation of concentration scores of school students in pre test ($M= 9.2, 9$ & $SD= 2.25, 3.04$) between control and experimental group which was not statistically significant ($p<0.05$). Whereas after virtual reality therapy the difference in the mean and standard deviation ($M= 8.4, 6.7, SD= 2.92, 1.90$) between control and experimental group of school students was statistically significant ($P< 0.05$). It can be attributed to the effectiveness of virtual reality therapy upon concentration. Hence the null hypothesis H_0 1 “There will be no significant difference in the level of concentration in control and experimental group of school students before and after administration of virtual reality therapy” is rejected.

The findings are consistent with study conducted by Cho, Lee, Ku et, al., (2002) on attention enhancement system using virtual reality and EEG biofeedback among children. In this study researchers took 50 subjects with inclusion criteria are who aged 14 to 18, who had committed crimes and had been isolated in a reformatory. They had some difficulty in learning in school and they were inattentive, impulsive, hyperactive and distracted. Although they were not officially diagnosed as ADHD, about 30% of them most likely had ADHD. They were randomly assigned to one of five 10-subject groups: a control Group, two placebo groups, and two experimental groups. Each group consisted of 10 subjects, respectively. The experimental groups and the placebo groups underwent 8 sessions over two weeks, which were about 20 minutes in length. The control group underwent no training session during the same period of time. Hence inattentiveness of the experimental groups became reduced and they were supposed to be consistently attentive. The commission errors and response times were also reduced to a small degree but those were not significant.

The third objective of the study was to determine the level of satisfaction in secondary school students regarding virtual reality therapy

While planning for any intervention it is important to be aware of the participants, satisfaction of their intervention, so as to gain their cooperation and to continue the intervention even after the completion of the study. Satisfaction arises from a person when a therapy is balanced between the study participants choice and professional responsibility and high level of satisfaction can be obtained when the effects of the therapy are already expected by the nurse.

The researcher found that most of school students were highly satisfied regarding the intervention of virtual reality therapy. These findings indicate that the administration of virtual reality therapy is effective in improving concentration and attention span level of students. It is an intervention using technology for presenting the user with interaction virtual or mixed reality environment.

The fourth Objective of the Study to find out the association between selected variables and level of attention span among school students before and after virtual reality therapy.

Corresponding hypothesis was Ho 2 ‘There will be no significant association between selected demographical variables and level of attention span in secondary school students of before and after administration of virtual reality therapy’.

Chi – square test was used to find out the association between selected variables and the level of attention span. It is found that there was no significant association between the level of concentration, attention span and the selected variables of the secondary school students. Hence the null hypothesis Ho2 was retained.

Even though attention span of children may be influenced by various demographic factors, lack of association in this study may be due to small sample size.

The fifth Objective of the Study to find out the association between selected variables and level of concentration among school students before and after virtual reality therapy.

Corresponding hypothesis was Ho3 ‘There will be no significant association between selected demographical variables and level of concentration in secondary school students of before and after administration of virtual reality therapy’.

Chi – square test was used to find out the association between selected variables and the level of concentration. It is found that there was no significant association between the level of concentration and the selected variables of the secondary school students. Hence the null hypothesis Ho3 was retained.

Even though level of concentration of children may be influenced by various demographic factors, lack of association in this study may be due to small sample size.

Summary

This chapter dealt with the objectives of the study, major findings of the students' background characteristics of school students with less level of concentration and attention span among school students before and after virtual reality therapy, Mean and Standard Deviation of concentration and attention span level before and after virtual reality therapy, association between the selected demographic and clinical variable and level of concentration and attention span of the school students and the level of satisfaction of the virtual reality therapy.

CHAPTER VI

SUMMARY, CONCLUSION, IMPLICATION AND RECOMMENDATION

Summary

The aim of the study is to assess the effectiveness of virtual reality therapy upon Attention Span and Concentration among Secondary School Children in Selected Schools, Chennai.

Objectives of the study

- ✓ To assess the level of attention span and concentration in experimental and control group of children before and after administration of virtual reality therapy.
- ✓ To evaluate the effectiveness of virtual reality therapy by comparing the levels of attention span and concentration before and after administration of virtual reality therapy.
- ✓ To determine the level of satisfaction among the secondary school children regarding administration of virtual reality therapy.
- ✓ To find out the association between selected demographic variables and the level of attention span in experimental and control group before and after administration of virtual reality therapy.
- ✓ To find out the association between selected demographic variables and the level of concentration in experimental and control group before and after administration of virtual reality therapy.

Null hypotheses

The null hypothesis stated are:

H₀₁: There will be no significant difference in level of attention span and concentration between experimental and control group before and after administration of virtual reality therapy.

H₀₂: There will be no significant association between selected demographical variables and level of attention span in secondary school students of before and after administration of virtual reality therapy.

H₀₃: There will be no significant association between selected demographical variables and level of concentration in secondary school students of before and after administration of virtual reality therapy.

Major findings of the study

Student's background characteristics

The study findings show that a more than half of students were aged between 12-13 years (53.3 %, 50%) with the mean age of 13 years, majority of school students were males (66.7%, 68.3%), studying 8th class (60%, 56.7%), and their academic performance (marks score in previous academic year) was between 76-90 percentage (50%, 46.7%). Most of the school students' spending time to study in home after school has ranged between 76-90% (63.3%, 73.3%) in control and experimental group. Attention span without any distraction in majority of school students ranges between 21-30 minutes (60%, 43.3%) in control and experimental group respectively.

Findings also reveal that there is no statistically significant difference between control group and experimental group with regard to background characteristics of the students' ($p>0.05$) indicating the homogeneity of the groups.

Level of concentration and attention span among secondary school students

The study results show that 60%, 56.7% of the control group of school students' have average level to above average level of attention span before and after virtual reality therapy.

Whereas among experimental group of the school students, majority were found to have average level of attention before administration of virtual reality therapy (60%), whereas after virtual reality therapy most of them had above average level attention span (93.3%).

The study depicts that in control group majority of the students' concentration (needs improvement) (83.3%, 70%) before and after virtual reality therapy. Whereas in experimental group of the school students, majority (70%) were found to have needs improvement of concentration before administration of virtual reality therapy whereas after virtual reality therapy more than half of them (60%) had good concentration.

It may be due to classroom noise level, student behavior, electronic devices, fatigue, hunger, thirst, external noises, physical affliction, personal issues. The attention span of a young child lasts roughly five minutes. Among individuals of all ages, total uninterrupted attention span rarely exceeds 40 minutes, after which time repeated refocusing is required (Dukette and Cornish, 2009).

Effectiveness of virtual reality therapy by comparing the level of concentration and attention span

The difference in mean and standard deviation of attention span scores of school students in pre test ($M = 55.6, 57.1, SD = 7.03, 7.4$) between control and experimental group which was not statistically significant ($p < 0.05$). Whereas after virtual reality therapy the difference in the mean and standard deviation ($M = 56.5, 61.9, SD = 6.9, 5.8$) between control and experimental group of school students was statistically significant ($P < 0.05$). It can be

attributed to the effectiveness of virtual reality therapy upon attention span. Hence the null hypothesis H_{01} “There will be no significant difference in the level of attention span in control and experimental group of school students before and after administration of virtual reality therapy” is rejected.

The difference in mean and standard deviation of concentration scores of school students in pre test ($M= 9.2, 9$ & $SD= 2.25, 3.04$) between control and experimental group which was not statistically significant ($p<0.05$). Whereas after virtual reality therapy the difference in the mean and standard deviation ($M= 8.4, 6.7, SD= 2.92, 1.90$) between control and experimental group of school students was statistically significant ($P< 0.05$). It can be attributed to the effectiveness of virtual reality therapy upon concentration. Hence the null hypothesis H_{01} “There will be no significant difference in the level of concentration in control and experimental group of school students before and after administration of virtual reality therapy” is rejected.

Level of satisfaction of virtual reality therapy

The researcher found that most of school students were highly satisfied regarding the intervention of virtual reality therapy. These findings indicate that the administration of virtual reality therapy is effective in improving concentration and attention span level of students. It is an intervention using technology for presenting the user with interaction virtual or mixed reality environment.

Association Between the Selected Variables and Level of attention span Among School students

Chi – square test was used to find out the association between selected variables and the level of attention span. It is found that there was no significant association between the level of concentration, attention span and the selected variables of the secondary school students. Hence the null hypothesis H_{02} was retained.

Association Between the Selected Variables and concentration Among School students

Chi – square test was used to find out the association between selected variables and the level of concentration. It is found that there was no significant association between the level of concentration and the selected variables of the secondary school students. Hence the null hypothesis H_0 3 was retained.

Conclusion

The findings of the study reveal that attention span and concentration lack, are one of the common problems faced by the school students. It may be due to various factors such as neurotransmitter imbalance, increasing nuclear family system and inadequate time to take care of the children by parents, misuse of technology etc. Virtual reality therapy is a non-pharmacological psychosocial intervention for the improvement of attention span and concentration, which can be practiced by secondary school students to improve level of attention span and concentration.

Implications

Based on the findings of the study, the researcher recommends the implications on Nursing practice, Nursing education, Nursing administration, Nursing research.

Nursing Practice

The findings of this study revealed that about 80% of school students had middle level of concentration and attention span. The study shows that stress was experienced by school irrespective of age, sex, education status or any other student's background characteristics of school students. This underscores the need for school students to practice various concentration and attention span promoting measures including virtual reality therapy daily in their life. Virtual reality therapy is more effective for improve the concentration and attention span. With emerging health care trends pediatric nurses must also know about the virtual reality therapy as a part of holistic care concept. This helps the pediatric nurses to use virtual reality therapy as best therapy and one of the holistic approach of improve the concentration and attention span.

Nursing Education

Integration of theory and practice is important in nursing education. With the emerging health trends, nursing education must focus on innovation to enhance nursing care. Some research suggests that educational stress among health care professional is currently a major concern in health policy. The research findings suggest that supportive relationships with peers may reduce the occurrence of high stress level among school students one of a major factor of distracted concentration and attention span. Education curriculum should be incorporated with emphasis on stress reduction and to improve psychosocial environment in the school. The school students should be taught about the importance of reducing stress to enhance a high quality personal and professional qualities of a person.

Nursing Administration

With technological advances and ever growing challenges of health care, administrators have the responsibility to provide continuing nursing education opportunities to understand the psychosocial intervention including virtual reality therapy. This enables the nurses to update the knowledge and to render the cost effective care to the public. The nurse administrators must periodically organize formal training program for school students to improve concentration and attention span can be organized by the nurse educators in collaboration with the community health nurses. Nurse administrator can arrange diversional activities, health education sessions to encourage school students to reduce curriculum related stress and perform well in their academic and personal life.

Nursing Research

In India, evidence based clinical strategies are not sufficient to address barriers to reduce the stress and ways to improve concentration and attention span. Nursing students to be encouraged to undertake research studies in the area of concentration and attention span among school professionals and to disseminate the findings can be tried for its effectiveness on concentration and attention span.

Recommendations

- The study can be conducted on larger sample to generalize the results.
- The study can be conducted among the other group of school students like intellectually disabled children.
- The study could be replicated in other settings like the community and colleges etc.
- A study can be conducted to assess the effectiveness of virtual reality therapy on quality of life among the alcoholics, wives and children of alcoholics.
- A comparative study can be conducted to evaluate the effectiveness of various other interventions to help the school students in improving their concentration and attention span.
- The study can be conducted among the autistic children to improve attention and concentration.

Limitations

- The study findings cannot be generalized due to small sample size.
- Investigator could not find much published studies on Virtual reality therapy on concentration and attention span.
- Setting was selected based on the convenience of the researcher.

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APPENDIX I
LETTER SEEKING PERMISSION TO CONDUCT STUDY



Apollo College of Nursing

(Recognised by the Indian Nursing Council) and Affiliated to
the Tamil Nadu Dr. M.G.R. Medical University, Chennai)

CO/0192/16

18.08.2016

To

The Head master,
UCCK Matriculation school,
Ayanambakkam
Chennai – 600 095.

Respected Madam,

Sub: To request permission for research study- Reg

Greeting!! As a part of the curriculum requirement our 2nd year M.Sc (N) student Ms.Anusha Siva Kumar has selected the following title for her research study.

“An Experimental study to assess the Effectiveness of Virtual Reality Therapy upon Attention Span and Concentration among Secondary School Students”

So I kindly request your good selves to permit her to conduct study in your esteemed hospital.

Thanking you,

Dr.
Dr.LATHA VENKATESAN
PRINCIPAL

Permitted by,
Latha Venkatesan
8-16
C. MAYIL VEDURAI M.Sc. B.Ed.
PRINCIPAL
UCCK MAT. HIG. SEC. SCHOOL
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APPENDIX II

ETHICAL COMMITTEE CLEARANCE LETTER

Institutional Ethics Committee - Clinical Studies

Reg.No.: ECR/37/Inst/TN/2013



25 Nov 2016

To,
Ms. Sivakumar, Anusha
First year, M.Sc. (Nursing),
Department of Psychiatric Health Nursing,
Apollo College of Nursing, Chennai.

Ref: An Experimental Study to Assess the Effectiveness of Virtual Reality Therapy upon Attention Span and Concentration among Secondary School students in Selected Schools, Chennai.

Sub: Approval of the above referenced project and its related documents.

Dear Ms. Sivakumar, Anusha,

The Institutional Ethics Committee-Clinical Studies has received the following document submitted by you related to the conduct of the above-referenced study -

- Project Proposal
- Consent form

The Institutional Ethics Committee-Clinical Studies reviewed and discussed the project proposal documents submitted by you at a meeting held on 22 November 2016.

The following Institutional Ethics Committee – Clinical Studies members were present at the meeting held on 22nd Nov 2016 at 3.30 PM at, Apollo Research & Innovations, Conference Hall, Room No: 19, 2nd Floor, Krishnadeep Chambers, (Apollo Hospitals, Annex No: 1), Wallace Garden, Chennai – 600006

S. No	Name	Gender	Designation	Affiliation	Position in the committee
1	Dr. Rema Menon	F	Blood Bank Transfusion Services	Apollo Hospitals, Chennai	Member Secretary
2	Dr. Pradeep Kumar	M	Pharmacologist	Apollo Hospitals, Chennai	Pharmacologist
3	Ms. Maimoona Badsha	F	Lawyer	Independent legal Practitioner, Chennai	Lawyer
4	Mrs. Malathy Chandrasekhar	F	Home based teacher	Freelance	Layperson
5	Dr. K. Sathyamurthi	M	Asst. Professor	Madras School of Social work, Chennai	Social Scientist

Apollo Hospitals Enterprise Limited,

21, Greams Lane, Off Greams Road, Chennai - 600 006, Tamil Nadu, India. Tel : +91-44-2829 5045 / 6641 Fax : +91-44-2829 4449

E-mail : ecapollochennai@gmail.com

Institutional Ethics Committee - Clinical Studies

Reg.No.: ECR/37/Inst/TN/2013



The Institutional Ethics Committee-Clinical Studies reviewed the proposal, its methodology and design of the study. The proposed thesis work is approved in the presented form without any modifications.

The Institutional Ethics Committee-Clinical Studies review and approval of the report is only to meet their academic requirement and will not amount to any approval of the conclusion / recommendations as conclusive, deserving adoption and implementations, in any form, in any health care institution.

The Institutional Ethics Committee-Clinical Studies is constituted and works as per ICH-GCP, ICMR and revised Schedule Y guidelines.

Regards,

Dr. Rema Menon,
Member Secretary,
Institutional Ethics Committee-Clinical Studies,
Apollo Hospitals,
Chennai.

Date: 25/11/2016

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE CLINICAL STUDIES
APOLLO HOSPITALS, AHIL
CHENNAI, TAMILNADU.

Apollo Hospitals Enterprise Limited,

21, Greaves Lane, Off Greaves Road, Chennai - 600 006, Tamil Nadu, India. Tel : +91-44-2829 5045 / 6641 Fax : +91-44-2829 4449

E-mail : ecapollochennai@gmail.com

APPENDIX III
LETTER SEEKING PERMISSION TO USE THE TOOL

From

Ms. Sivakumar. Anusha
M.Sc. (Nursing) Second Year,
Apollo College of Nursing,
Chennai – 600095.

To

Dr. Latha Venkatesan
Principal,
Apollo College of Nursing.

Sub: Requesting for opinions and suggestions of experts for establishing content validity for research tool.

Respected Madam,

I am a postgraduate student of the Apollo College of Nursing. I have selected the below mentioned topic for research project to be submitted to the Tamil Nadu Dr. M.G.R Medical University, Chennai as a partial fulfillment of Masters of Nursing Degree. **“An experimental study to assess the effectiveness of virtual reality therapy upon attention span and concentration among secondary school students in selected school, Chennai.”** With regards may I kindly request you to validate my tool for its appropriateness and relevancy. I am enclosing the Background, Need for the study, Statement of the problem, Objectives of the study, Demographic Variable Proforma, Standardized attention span, concentration assessment tool and rating scale on satisfaction of participants. I would be highly obliged and remain thankful for your great help if you could validate and sent it as soon as possible.

Thanking you,

Date :

Yours sincerely,

Place :

Sivakumar. Anusha

APPENDIX IV
CONTENT VALIDITY CERTIFICATE

This is to certify that tools and content for the research study developed by Sivakumar. Anusha, II year M.Sc (Nursing) student of Apollo College of Nursing for her dissertation “ An experimental study to assess the effectiveness of virtual reality therapy upon attention span and concentration among secondary school students in selected school, Chennai” was validated.

Signature of the Expert

Name and Designation

APPENDIX V

LIST OF EXPERTS FOR CONTENT VALIDITY

1. Dr. Latha Venkatesan, M.Sc (N)., M.Phil. (N)., Ph.D.(N)., M.B.A.,

Principal and Professor in Maternity Nursing,

Apollo College of Nursing,

Chennai- 600 095

2. Dr. Lizy Sonia. A, M.Sc.(N).,

Vice Principal and Professor in Medical Surgical Nursing,

Apollo College of Nursing,

Chennai-600 095

3. Dr. Frenandez, MD, DPM, FIPS

Chief, Psycholab.

4. Dr.M. Kumerasan, M.S, D.L.O., F.I.C.S., F.R.S.H.,

E.N.T Consultant,

Siva E.N.T Hospital, Chennai

5. Mrs. Anuradha.C. M.Sc.(N)., M.Sc. (Psy).,

Associate professor,

Department of Mental Health Nursing

Apollo College of Nursing,

Chennai- 600 095.

6. Mrs. Stella Mary. I, M.Sc (N).,

Reader

Department of Mental Health Nursing,

Apollo College of Nursing

APPENDIX VI
RESEARCH PARTICIPANTS CONSENT FORM

Dear participants,

I am a M.Sc (N) student Apollo College of nursing, Chennai. As a part of my study, a research on **“A Study to Assess the Effectiveness of Virtual Reality Therapy upon Attention Span and Concentration among Secondary school children”** is selected to be conducted. The findings of the study will be helpful for secondary school students to maintain good Attention span and Concentration.

I hereby seek your consent and cooperation to participate in the study. Please be frank and honest in your responses. The information collected will be kept confidential and anonymity will be obtained.

Signature of the investigator

I..... here by consent to participate in the study.

Place

Date:

Signature of the participant

APPENDIX VII

CERTIFICATE OF TRAINING IN VIRTUAL REALITY THERAPY



Medical Advance Research Foundation

(Public Charitable Trust)

Recipient : Science Popularisation Award, Government of Tamil Nadu 2001 - 2002

Managing Trustee :

Dr. M. KUMARESAN, M.S. (E.N.T.) D.L.O.

MEMBER, POLITZER SOCIETY, USA

President, Madras - India Regional Chapter of the Acoustical Society of America

Secretary, Acoustical Foundation Education and Charitable Trust

Director, International Research Institute for the Deaf.

RECIPIENT OF NATIONAL AND STATE GOVERNMENT AWARDS

Managing Director, Bharath Institute of Para-Medical Sciences

Chairman, Bharath Community College.

Office :

SIVA E.N.T. HOSPITAL

No. 159, Avvai Shanmugam Salai,
Royapettah, Chennai - 600 014.

Tamil Nadu, India.

Phone : 2811 6807

E-mail : kumaresan@doctor.com

Cell : 98410 55774

Research :


Virtual Reality Medicine

Date : 9.11.16



Certification of Virtual Reality Therapy Completion

This is to certify Miss. Sivakumar. Anusha, M.Sc Nursing II year has Successfully Completed
the Training for Virtual Reality Therapy Aim, Target People, Methodology, outcome
Conducted from 4/11/2016 to 8/11/2016


9.11.16

APPENDIX VIII
CERTIFICATE FOR ENGLISH EDITING

TO WHOMSOEVER IT MAY CONCERN

This is to certify that the dissertation entitled "An Experimental Study To Assess The Effectiveness of Virtual Reality Therapy Upon Attention Span And Concentration Among Secondary School Students, Chennai" by Sivakumar. Anusha, Ilyr M. Sc Nursing student of Apollo College of Nursing, was edited for English language appropriateness.

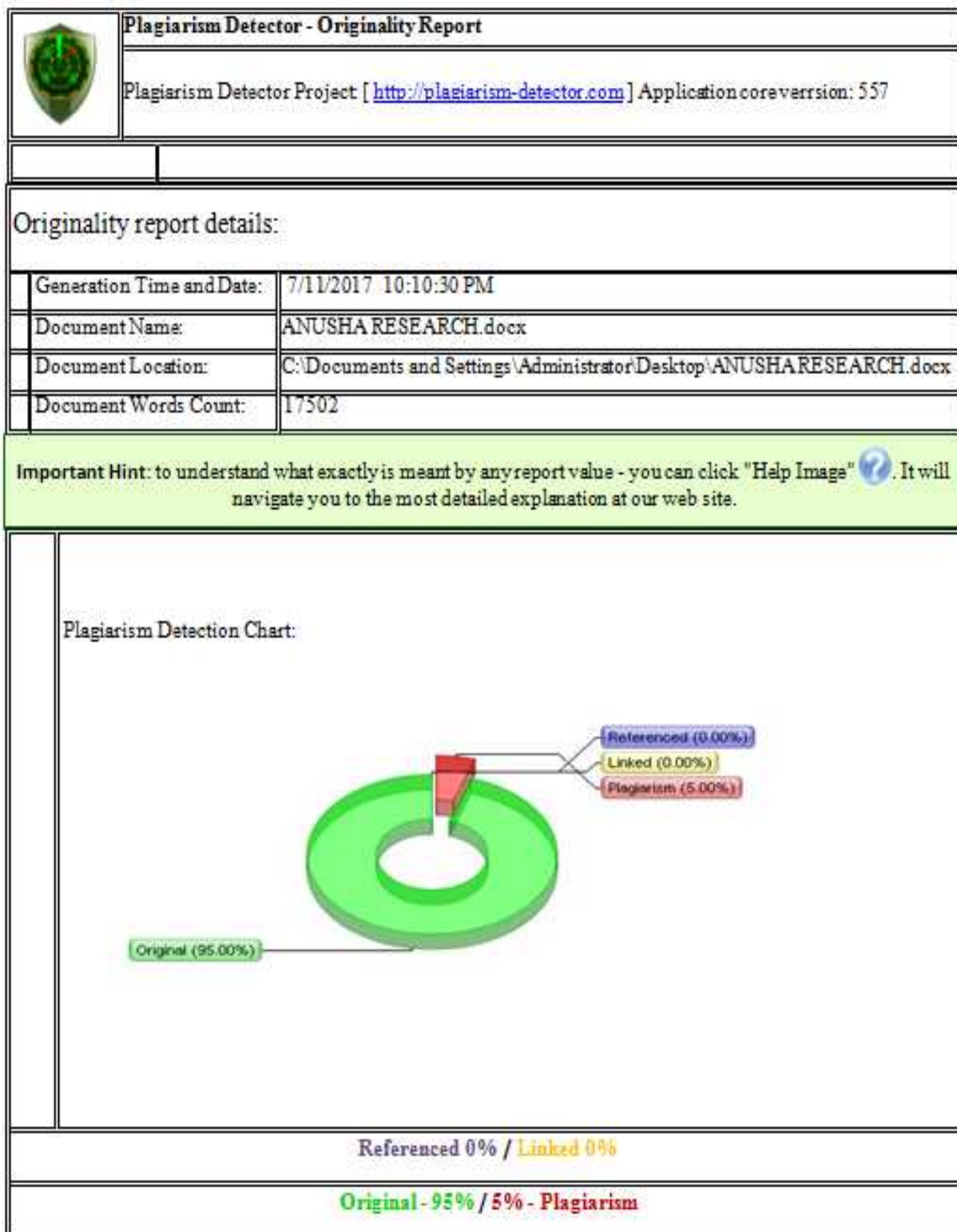
Prof. J.L. NARASIMHAN
New No.8, Second Main Road,
Block B - F1, Krishna Nagar,
Chromepet, Chennai-600 044.
Cell : 94445 54720
e-mail : profjln@yahoo.com



Signature

APPENDIX IX

PLAGIARISM ORIGINALITY REPORT



APPENDIX X

BACKGROUD CHARACTERISTICS PROFORM FOR SCHOOL STUDENTS

Purpose:

This proforma is used to measure the demographic variables such as age, gender, grade of student, number of classes per day, academic performance, time spend to study in home, attention span without any distractions.

Instruction:

- Please put a tick mark () in the following options.
- Please be frank in answering.

Identification data:

Sample no

1. Age in years

2. Gender

2.1.1 Male

2.1.2 Female

3. Education status

2.1.3 8th class

2.1.4 9th class

4. Number of classes per day

5. Academic performance (percentage scored in latest examination)

6. How many hours you spend the time to study in a day at home

7. How much time you can be attentive with good concentration without

any distraction (mention in minutes)

APPENDIX XI

MINDFULNESS SCALE

Instructions:

Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what really reflects your experience rather than what you think your experience should be. Please treat each item separately from every other item.

	1	2	3	4	5	6
	Almost Always	Very Frequently	Somewhat Frequently	Somewhat Infrequently	Very Infrequently	Almost Never
ITEMS	1	2	3	4	5	6
I could be experiencing some emotion and not be conscious of it until some time later.						
I break or spill things because of carelessness, not paying attention, or thinking of something else.						
I find it difficult to stay focused on what's happening in the present						
I tend to walk quickly to get where I'm going without paying attention to what I experience along the way						
I tend not to notice feelings of physical tension or discomfort until they really grab my attention.						
I forget a person's name almost as soon as I've been told it for the first time.						
It seems I am "running on automatic," without much						

awareness of what I'm doing.						
I rush through activities without being really attentive to them.						
I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there						
I do jobs or tasks automatically, without being aware of what I'm doing						
I find myself listening to someone with one ear, doing something else at the same time						
I drive places on 'automatic pilot' and then wonder why I went there.						
I find myself preoccupied with the future or the past.						
I find myself doing things without paying attention.						
I snack without being aware that I'm eating.						

Guidelines for scoring/ interpretation:

By adding the scores of all 15 items total 1-90

Categories	Score
Low	1-19
Average	20-35
Above average	36-75
High	76-90

APPENDIX XII

CONCENTRATION QUESTIONNAIRE

Purpose:

This questionnaire to assess the level of concentration among the school students’.

Instructions:

- Please put a tick mark () in the following options.
- Please be frank in answering. The information will be kept confidentially and will be used for research purpose only.

S. NO	ITEMS	YES	NO
1	I often daydream during lectures or tune out when a speaker is boring.		
2	I am easily distracted by background noise (e.g., voices, noise).		
3	I am easily distracted by visual stimulation (e.g., movement, colors).		
4	I am easily distracted by internal thoughts or feelings.		
5	My study area is often cluttered or disorganized		
6	It is difficult to listen even when spoken to directly.		
7	I have trouble sleeping through the night.		
8	Because my mind wanders, I find it difficult to concentrate for more than 15 minutes.		
9	I am not able to keep my mind focused on studying.		
10	It is difficult for me to sit still for 50 minutes.		
11	I often procrastinate on projects and papers.		
12	I turn on the radio, television, or stereo when I study.		
13	I have trouble getting back to work after I’ve been interrupted.		
14	I find that even though I schedule time, I don't actually accomplish very much.		
15	When I finish reading a textbook, I often have to re-read what I’ve read and/or I often don’t really remember what I've read.		
16	I often speak or act without thinking.		
17	I have difficulty paying close attention to details which often results in careless errors.		

Guidelines for scoring/ interpretation:

By adding the scores of all 17 items total 0-17

Categories	Score
Good concentration	0-5
Needs improvement	6-11
Needs more help and improvement	12-17

APPENDIX XIII

RATING SCALE FOR ASSESSING LEVEL OF SATISFACTION ON VIRTUAL REALITY THERAPY

Purpose:

This rating scale is designed to assess the level of satisfaction of the participants.

This is developed by the investigator to assess the satisfaction of the virtual reality therapy among students. This is a 4 point rating scale ranging from 4-1 (highly satisfied, satisfied, dissatisfied and highly dissatisfied).

Instruction:

There are 10 items below. Kindly read the items. Response extends from highly satisfied, satisfied, dissatisfied and highly dissatisfied. Put a tick mark against your answers. Describe your responses freely and frankly. The responses will be kept confidential and used for research purpose only.

S.NO	ITEMS	Highly Satisfied	Satisfied	Dissatisfied	Highly Dissatisfied
1.	Explanation regarding virtual reality therapy				
2.	Approach of the researcher				
3.	Time spend by the researcher				
4.	Duration of the programme				
5.	Arrangements made during the programme				

6.	The programme was easy to understand				
7.	Use of demonstration				
8.	Involvement of the participants				
9.	Given at the appropriate time				
10.	Usefulness				

Scoring interpretation

Score	Percentage	Level of Satisfaction
< 10	<25%	Highly dissatisfied
10-20	25-50%	Dissatisfied
20-30	50-75%	Satisfied
30-40	>75%	Highly satisfied

APPENDIX XIV
VIRTUAL REALITY THERAPY

TOPIC : Virtual Reality Therapy

GROUP : School Students

PLACE : UCCK School, Chennai

DURATION :

METHOD OF TEACHING : Lecture cum discussion and demonstration

TEACHING AIDS : Video Presentations, LCD, Television Monitor

EUCATOR : M.Sc., (N) II year Student, Apollo College of Nursing, Chennai.

OBJECTIVES :

At the end of the session school students will be able to,

- ✓ Explain what is virtual reality therapy
- ✓ Justify the end for virtual reality therapy upon concentration and attention span among secondary school students
- ✓ Practice virtual reality therapy
- ✓ Ventilate their feelings during virtual reality therapy

SPECIFIC OBJECTIVES	CONTENT	LEARNER'S ACTIVITY
Introduction virtual reality therapy	<p>INTRODUCTION</p> <p>Virtual reality is a technique that allows a person to participate actively in a sense of being present in the virtual environment. Virtual reality has been proposed as a new way of conducting exposure therapy because it can provide a sense of being present in a stressed situation. This method appears to have several advantages over standard exposure therapy Virtual is artificial and reality is what we experience. The field of Virtual reality is growing rapidly due to recent advances in artificial intelligence and computer graphics. It has been believed that artificial intelligence can help to improve human health and longevity.</p> <p>Virtual reality was invented by Morton H. Eiligin in 1956. Virtual reality was introduced in medicine by Dr. Ralph Larson in the year 1990. He introduced virtual reality in medicine to treat his own fear of height (Acrophobia). At present virtual reality is being used as part of treatment. Prof. V.S.Ramachandran from the university of California is noted for his use of virtual reality and the neuro imaging – mirror neurons.</p>	<ul style="list-style-type: none"> - Lecture cum discussion - Listening
Define virtual reality therapy	<p>DEFINITION:</p> <p>Virtual reality is a form of technology which creates computer generated worlds or immersive environment, which people can interact with it. Virtual is artificial and reality is what we experience. So, the term virtual reality basically</p>	<ul style="list-style-type: none"> - Lecture cum discussion - Listening

	<p>means “NearReality”</p> <p>Virtual reality treatment refers to immersive, interactive, multisensory, Viewer centered, sensed, projector viewed theatre environment which can be explored and interacted with by a person. The person becomes part of this virtual world or is immersed within this therapeutic environment and whilst, they will be able to manipulate objects or perform a series of actions displayed on the screen. Thereby the person feels relief from his problems by permanently registering the positive effects in the brain.</p> <p>Virtual reality therapy is the simulation of physical presence in the real or imaginary world.</p>	
List down the aims of Virtual Reality therapy	<p>AIMS OF VIRTUAL REALITY THERAPY</p> <ul style="list-style-type: none"> • To promote and protect people’s help throughout their lives. • To reduce the incidence of major diseases and to alleviate the suffering. <p>USES OF VIRTUAL REALITY THERAPY;</p> <ul style="list-style-type: none"> • The virtual reality therapy is oftenly used to help patients face and overcome 	
State the uses of virtual reality therapy	<p>fear and phobias.</p> <ul style="list-style-type: none"> • This can be done in a monitored, controlled, sensed, projector viewed theatre environment, tailored to the needs of each individual patient. <p>Rehabilitative programmes for:</p> <ul style="list-style-type: none"> • Vertigo, • Tinnitus, 	<p>-Lecture cum discussion</p> <p>-Listening</p>

	<ul style="list-style-type: none"> • Vocal injuries, • Stress, • Headache, • Dementia, • Schizophrenia • Sinusitis, • Voice care • Stuttering • Behavior Problems, • Contractures 	-Lecture-cum discussion -Listening
list down the characteristics of virtual reality therapy	CHARACTERISTICS OF VIRTUAL REALITY <ul style="list-style-type: none"> • Visual realism • Time varying, animated • User centered immersive view • User centered or closed-loop, interaction, • Multisensory interaction • From user; • speech, • wholebody movement, • To user; 	

	<ul style="list-style-type: none"> • visual, • auditory, • kinesthetic, • tactile 	-Lecture-cum discussion -Listening
Justify the need for virtual reality therapy upon stress among school students	<p>NEED FOR VIRTUAL REALITY THERAPY UPON STRESS AMONG SCHOOL STUDENTS:</p> <p>In children, the physiologic responses of stress can interfere with learning. In addition to contending with grades, long term hours of studying, work, family and other personal commitments school students are also faced with examinations. Examination has been identified as one of the most stress producing components in any educational programmes. Lack of adequate knowledge, fear of making mistakes, physical discomfort, family problems, examinations as the factors influencing the level of stress in students resulting in poor performance of students.</p> <p>The virtual reality medicine helps to improve the co-ordination between mind and body. Exercise in reality affects many regions in the nervous system and sets on the pleasure chemicals such as serotonin and dopamine that makes the person feel calm, happy and free. The benefits of virtual reality therapy includes stimulation of learning, improvement in goal setting, social skills and decision making. It also improves self-esteem, cognitive skills and increases creative thoughts.</p>	

Elaborate the virtual reality procedure	<p>HOW VIRTUAL REALITY PROCEDURE IS PERFORMED?</p> <p>Central to cognitive therapy are cognitive change techniques, sometimes called “Cognitive restructuring”. These procedures help patients challenge and correct negative thinking patterns about certain circumstances that trigger dysfunctional emotional responses. Relaxation training and breathing exercises are often used adjunctively to cognitive techniques to provide stressed individual with a skill to decrease symptoms of over arousal.</p>	
Describe the virtual reality environment	<p>VIRTUAL ENVIRONMENT</p> <p>Successful virtual environments depend on the smooth integration of:</p> <ul style="list-style-type: none"> – Visual Display – Head position sensing – Hand-position sensing – Force feedback – Sound input and output – Other sensations – Cooperative and competitive virtual reality 	<p>-Lecture-cum discussion</p> <p>-Listening</p>
	<p>TYPES OF VIRTUAL ENVIRONMENT;</p> <ul style="list-style-type: none"> • Virtual reality • Augmented reality • Situational awareness 	Demonstration and

Enumerate the types of virtual environment	<p>VIRTUAL REALITY</p> <p>A form of human computer interaction in which real or imaginary environments are simulated and user interacts with it and manipulate those environment.</p> <p>AUGMENTED REALITY</p> <p>Synthesized graphics superimposed on a real world view and it helps to repair manual, construction, blueprint etc.</p> <p>VIRTUAL REALITY PLAY STATION</p> <p>Virtual reality is an artificial environment created by software and projected by capturing the user by sensor. The user will be projected in the screen as a disease free user. The person suspend the belief of presence of disease and accepts the real environment. When the brain is preoccupied with virtual environment, it does not perceive other stimuli as effective as it otherwise good. This mechanism in turn, greatly lessens the sensation of real disease of the patient. The Virtual Reality replicates real life situation. Even though it may look like a game, but what we are doing is giving a very scientific prescription to rehabilitate yourself. The real time behaviors motions are captured by the sensor plug into the presentation media for creating rehabilitation applications.</p>	re-demonstration
Demonstrate virtual reality play station		<ul style="list-style-type: none"> - Lecture cum discussion - Listening
	<p>BENEFITS OF VIRTUAL REALITY THERAPY</p> <ul style="list-style-type: none"> • Virtual reality stimulates learning • Improve goal setting • Improve social skills 	

Enlist the benefits of virtual reality therapy	<ul style="list-style-type: none"> • Reduce stress • Improve math skills • Improve language skills • Improve creative thinking • Improve cognitive skills • Improve decision making • Improves self esteem • Lose weight • Increases Creative thoughts • Good Physical Exercises 	Lecture cum discussion
Elaborate the current application of virtual reality therapy	<p>CURRENT APPLICATION OF VIRTUAL REALITY THERAPY:</p> <p>For an example of current treatment using Virtual reality therapy, there are many videos of actual sessions. There are VRT or Computerized CBT (CCBT) sessions, some immersive and some not, in which the user interacts with computer software (either on a PC, or sometimes via a voice-activated phone service), instead of face to face with a therapist. For people who are embarrassed by their phobias or feeling depressed and withdrawn, the prospect of having to speak to someone about their innermost problems can be unpleasant. In this respect, VIRT/CCBT either in a VR lab or online, is an option. With the huge number of PTSD sufferers and the shortage of available mental health</p>	

	<p>professional, VRIT is expanding. New Virtual reality therapy sessions are even being done via the well known Virtual reality provider Second Life. It is becoming well known enough to even be a question on Jeopardy.</p> <p>The use of Virtual reality continues to expand due to this effectiveness. In February 2006 the UK's National Institute of Health and Clinical Excellence (NICE) recommended that Virtual reality be made available for use within the across England and Wales, for patients presenting with mild/moderate depression, rather than immediately opting for antidepressant medication. The game has a number of features to help combat depression, where the user takes on a role of a character that travels through a fantasy world, combating 'literal' negative thoughts and learning techniques to manage their depression</p>	Lecture cum discussion
	<p>CONCLUSION</p> <p>Virtual reality is a new way of conducting exposure therapy because it can provide a sense of being present in a feared situation. It stimulates the physical presence in real or imaginary world. More specially designed environments with user friendly atmosphere can be created which allow for broader virtual reality usage in treatment and research.</p>	

APPENDIX XV
DATA CODING SHEET

Identification data:

Sample no

1. Age in years

2. Gender

1.1.1 Male

1.1.2 Female

3. Education status

1.1.3 8th class

1.1.4 9th class

4. Number of classes per day

5. Academic performance (percentage scored in latest examination)

6. How many hours you spend the time to study in a day at home

7. How much time you can be attentive with good concentration without

any distraction (mention in minutes)

APPENDIX XVI
MASTER CODING SHEET

S.No	Age	Gender	Edu	No.classes	Acca.prfl	Time to Study	Att. With't distraction	Concentration		Attention span	
								pre-test	post-test	pre-test	post-test
1	1.2	2.1	3.1	4.1	70%	2hrs	30 Min	9	9	55	55
2	1.2	2.1	3.1	4.1	75	2	30	8	7	65	69
3	1.2	2.1	3.1	4.1	70	3	60	10	12	62	62
4	1.2	2.1	3.1	4.1	80	2	30	11	9	55	62
5	1.2	2.1	3.1	4.1	75	2	40	8	8	66	66
6	1.2	2.1	3.1	4.1	96	2	40	6	4	67	70
7	1.3	2.1	3.1	4.1	70	1	40	9	10	52	52
8	1.2	2.1	3.1	4.1	80	3	30	9	6	49	57
9	1.2	2.1	3.1	4.1	80	2	30	10	9	49	54
10	1.2	2.1	3.1	4.1	80	2	30	10	5	54	58
11	1.2	2.1	3.1	4.1	80	2	30	14	14	51	54
12	1.1	2.1	3.1	4.1	85	2	30	13	10	54	56
13	1.2	2.1	3.1	4.1	80	2	30	13	11	54	46
14	1.2	2.1	3.1	4.1	50	2	30	10	6	46	57
15	1.2	2.1	3.1	4.1	80	2	30	13	14	58	50
16	1.5	2.1	3.1	4.1	70	3	50	14	10	50	58
17	1.2	2.1	3.1	4.1	65	3	50	11	10	46	58
18	1.3	2.1	3.1	4.1	80	3	30	14	9	58	60
19	1.5	2.1	3.1	4.1	70	3	50	10	9	52	55
20	1.2	2.1	3.1	4.1	85	2	30	12	9	54	57
21	1.2	2.1	3.1	4.1	85	2	30	12	8	47	72
22	1.2	2.1	3.1	4.1	80	2	30	8	5	75	75
23	1.5	2.1	3.1	4.1	89	4	30	11	8	69	69
24	1.2	2.2	3.1	4.1	65	2	40	8	7	57	63
25	1.2	2.2	3.1	4.1	78	2	40	8	10	51	54
26	1.2	2.2	3.1	4.1	80	2	40	13	10	53	55
27	1.2	2.2	3.1	4.1	74	2	20	9	12	53	55
28	1.2	2.2	3.1	4.1	70	2	35	8	6	66	70
29	1.2	2.2	3.1	4.1	74	2	30	9	10	51	52

30	1.2	2.2	3.1	4.1	82	1.5	35	9	6	55	59
31	1.3	2.2	3.1	4.1	64	3	25	10	8	50	64
32	1.3	2.2	3.1	4.1	40	5	10	8	4	55	60
33	1.2	2.2	3.1	4.1	85.3	3	35	8	3	63	62
34	1.2	2.2	3.1	4.1	76.3	2	30	8	3	62	67
35	1.2	2.2	3.1	4.1	75.6	2	30	5	2	60	49
36	1.2	2.2	3.2	4.2	90	1.5	10	14	10	52	64
37	1.3	2.2	3.2	4.2	76.6	2	30	10	5	46	60
38	1.4	2.2	3.2	4.2	65	2	20	11	6	52	58
39	1.3	2.2	3.2	4.2	79.8	4	30	10	9	63	65
40	1.4	2.2	3.2	4.2	79.4	3	30	8	5	63	69
41	1.3	2.2	3.2	4.2	88	3	30	6	8	68	66
42	1.3	2.2	3.2	4.2	84	1	20	11	7	52	57
43	1.2	2.2	3.2	4.2	74.2	2	35	8	11	67	57
44	1.3	2.2	3.2	4.2	75.2	3	20	7	3	55	62
45	1.2	2.1	3.2	4.2	78	2	25	10	11	55	51
46	1.4	2.1	3.2	4.2	57	2	30	6	4	54	60
47	1.3	2.1	3.2	4.2	56	2	25	6	5	50	60
48	1.3	2.1	3.2	4.2	60	2	20	9	8	48	55
49	1.3	2.1	3.2	4.2	70	4	30	7	4	66	58
50	1.3	2.1	3.2	4.2	70	3	10	2	1	65	68
51	1.3	2.1	3.2	4.2	58	2	30	4	7	55	50
52	1.3	2.1	3.2	4.2	70	2	40	5	3	74	73
53	1.3	2.1	3.2	4.2	84	4	35	9	7	49	55
54	1.4	2.1	3.2	4.2	80	2	45	8	6	49	55
55	1.3	2.1	3.2	4.2	60	2	35	10	7	59	49
56	1.3	2.1	3.2	4.2	59	1	25	10	7	50	53
57	1.4	2.1	3.2	4.2	85	3	30	10	6	45	50
58	1.3	2.1	3.2	4.2	56	2	20	6	4	64	64
59	1.4	2.1	3.2	4.2	51	2	20	7	5	56	46
60	1.4	2.1	3.2	4.2	70	3	35	6	5	62	66

APPENDIX XVII
PHOTOGRAPHS DURING DATA COLLECTION





